

**TOWARDS A MULTIMEDIA SIMULATION FOR
INTERPROFESSIONAL LEARNING: USING ACTIVITY
THEORY TO INFORM DESIGN**

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ABSTRACT

This thesis reports on a pilot case study that used activity theory in a pre-experimental phase of design-based research. The purpose of this study was to inform the initial design of a multimedia simulation for interprofessional education in the field of health and social care. Five subjects from five different health science disciplines participated in an observational study. Data collection focused on interactions between participants over three problem-based learning (PBL) sessions. Modified grounded theory coding techniques were applied within an activity theory analytic framework to illuminate structural tensions in PBL activity. Interviews with six participants were used to illuminate and corroborate findings. The results suggest three sets of structural tensions that affected interprofessional learning. These tensions suggest opportunities for instructional design improvement in which multimedia simulation could play a key supportive role. Simulation-based design alternatives are presented to resolve these tensions and to suggest new approaches to facilitating interprofessional learning.

Keywords:

Instructional systems design, educational technology, computer simulation education, interprofessional education

To my family.

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1.0 INTRODUCTION

1.1 Background

This study was inspired by previous work conducted as part of the HEALTHSIMNET project¹, which is a design-based research project that asks: How can computer-based multimedia simulation help to improve performance in the area of HIV/AIDS health a social care? At the early beginnings of this project, investigations focused on one part of this question, that is, how could performance be improved? Through seven interviews with health professionals and other care helpers, it became clear that a key component of improving performance was to improve the levels of interprofessional collaboration between health and social care stakeholders. This led to the development of a prototype that demonstrated some of our initial ideas about possible designs for a multimedia simulation for promoting interprofessional collaboration. The initial conceptual design was an example of an interactive multi-linear narrative that would allow users to assume the role of a health professional to try their hand at resolving practice issues in the domain of HIV/AIDS. However, early designs were single user simulations that would have added little value in an educational domain where collaborative learning is deemed essential for professional development. Moreover, this early design was based primarily on theoretically informed ideas about what might work in an interprofessional setting. Lacking was a grounded and pragmatic understanding about how interprofessional education methods are actually enacted, whether this tool could be successful in the “messiness” (Collins, Joseph, & Bielaczyc, 2004) of a real interprofessional learning environment, and how to direct development to address the current learning and instructional needs of an interprofessional setting. Thus, in order to produce a design that could be successful in a real educational setting, our work clearly needed to be informed by a better understanding about the factors that influence learning and collaboration in a real interprofessional learning environment.

¹ HEALTHSIMNET is a research project funded by the Social Sciences and Humanities Research Council (SSHRC) project: *Simulation and Advanced Gaming Environments (SAGE) for Learning*. A part of the Initiative on the New Economy and a Collaborative Research Initiative led by Dr David Kaufman & Dr Louise Sauve. For more information on this and other SAGE projects, visit: <http://www.sageforlearning.ca>

The pilot study reported in this thesis was conceived to help address this need. The purpose of this study was to gain an understanding about the nature and the outcomes of collaborative learning in a real interprofessional education environment and in particular, to inform the development of HEALTHSIMNET by examining how specific pedagogical elements are enacted and their collective influence on interprofessional learning. To assist our investigation, we adopted a conceptual framework called *activity theory* (Engeström, 1987; Leont'ev, 1978; Vygotsky, 1978). Activity theory provides a set of concepts for describing the structure, development, and context of human activity (Nardi, 1996). For this purpose, it was selected to help illuminate how interprofessional learning activity actually takes place, and more importantly, to help identify possibilities for educational improvement in which computer simulation could play a key supportive role. However, activity theory is without an established methodology for research. It offers conceptual tools that must to be “concretized” to the particular needs of a study (Engeström, 1990). In this study, the central aim was to identify learning and instructional needs in an interprofessional learning environment and to use findings to inform the design of HEALTHSIMNET. Activity theory suggests that some of the needs in an activity system can be illuminated by looking for the presence of *structural tensions*, or systemic deficiencies, contradictions, and other problems that could potentially hinder performance. Thus, to help inform the design of a multimedia simulation for interprofessional education, a pilot case study was developed that used activity theoretic principles to illuminate structural tensions in an undergraduate interprofessional learning environment.

The research questions that guided this study were:

- *How can activity theory be used to inform the design of a multimedia simulation for interprofessional education?*
- *What are the tensions that characterize learning in this interprofessional learning environment?*
- *How can a multimedia simulation be designed and used to resolve these tensions?*

Figure 1.1 Screenshot of an early HEALTHSIMNET prototype



1.2 Overview of the Chapters

Chapter Two provides a literature review that examines the key concepts and methods expressed in this thesis. Specifically, it presents a definition for design-based research, which is the research approach that is being taken in the HEALTHSIMNET project to investigate how multimedia simulation can be applied to expand possibilities for interprofessional learning. Next, an overview of IPE is presented that describes its goals and some of its methods. The section that follows examines a particular method called problem-based learning (PBL), which is both a potential pedagogical model for HEALTHSIMNET development and the object of this pilot case study. Then I outline some of the potential benefits of simulation for learning and point out the need to develop HEALTHSIMNET based on the learning and instructional needs of the learning environment that it is intended to support. Finally, I provide a background and description of activity theory and suggest how it might be used to help inform the design of a simulation-mediated activity for interprofessional learning.

In chapter three, details about the pilot case study are presented, including some information about the study participants, a description of the setting where the study was conducted, the data collection and triangulation method, and the method that was developed to illuminate structural tensions in the PBL activity. The main structural tensions that were illuminated in the study are presented and discussed in chapter four. In chapter five, three simulation-based alternatives to the current PBL design are suggested as possible resolutions to existing structural tensions. Finally, chapter six concludes with a revisiting of the research questions and a discussion on the limitations of this study, opportunities for future research, and contributions.

2.0 LITERATURE REVIEW

2.1 Design-based Research

This thesis reports on a pre-experimental design study carried out to inform the design of a multimedia simulation for interprofessional education called HEALTHSIMNET. This study represents an initial phase in what can be described as *design-based research* (Barab & Squire, 2004), also known as *design experiments* (Collins, 1999; Brown, 1992). This is a relatively new method for understanding learning and instruction that is highly interventionist (Cobb et al., 2003) and its intent is to “investigate the possibilities for educational improvement by bringing about new forms of learning in order to study them” (p. 10).

Compared to the analytic sciences, such as physics and anthropology, which are concerned with producing descriptions or theories of phenomenon, design research is concerned with improving the design of artefacts for everyday use (Collins, Joseph, & Bielaczyc, 2004). In this way, design-based research is theoretically and pragmatically oriented (Cobb, et al., 2003), that is, it emphasizes the production of theory that can be used to generate, select, and validate specific design alternatives at a level that is consequential for learning (diSessa & Cobb, 2004, p. 80).

Collins (1999) posits that educational design-based research has seven basic methodological characteristics that distinguish it from traditional experimental studies. First, design research employs formative evaluation methods that are carried out in the “messiness” of real learning situations. Second, design studies do not attempt to isolate subjects; rather, studies are situated in complex social situations. Third, multiple dependent variables are common, whereas most laboratory studies use single dependent variables. Fourth, in design research, seldom are there control variables; instead, the goal is to account for all the variables that could affect dependent variables. Fifth, design research begins with a planned approach that is sometimes revised in situ to adjust for material or procedural problems. Sixth, whereas laboratory studies restrict control to researchers, design experiments encourage participation from stakeholders to expand expertise for refining and analyzing a design. Lastly, one of the main goals of design research is to examine different aspects of a design and to produce a qualitative

and quantitative profile that characterizes the design in practice. This is in contrast to traditional psychological experiments, which focuses primarily on testing hypotheses. However, this does not mean that design experiments do not involve the testing of hypotheses, but rather that hypothesis testing is not an exclusive focus. This comparison offers a basic description of design-based research. As such, Shavelson *et al.* (2004) argue that these distinctions do not preclude the use of traditional experimental methods in design-based research. In some cases, the strengths of traditional psychological methods can serve to enhance design-based inquiries (Shavelson et al, 2004, p. 26).

Shavelson *et al.* (2004) posit that design-based research is iterative, process focused, interventionist, collaborative, multileveled, utility oriented, and theory driven. It is iterative in that it involves “progressive refinement” (Collins, Joseph, & Bielaczyc, 2004), or a spiral process of design that begins with implementing an initial design to “see how it works”. Then the design is validated against educational objectives and standards for learning and instruction. Problematic design issues are illuminated and potential resolutions are suggested. These resolutions are then implemented into the target practice setting, thereby beginning the next cycle of refinement. Design research is also collaborative because it involves stakeholder participation in all phases of design. It is multileveled because it often links classroom practices to the school, community, and district events or structures. It is also utility-oriented in that design researchers tend to approach their work with a transformative agenda (Barab & Squire, 2004). In other words, design-based research is concerned with improving opportunities for learning through the production of new artefacts. These artefacts can be “concrete” as in computer software, or process-based as in teaching experiments (Kelly, 2004). Lastly, design-based research requires testing, producing, and refining theories about learning and instruction that are not only relevant or of value to one context, but also more generally (Barab & Squire, 2004).

In our research, we are investigating how to design a multimedia simulation that can add educational value to a particular interprofessional learning environment. At this stage of research, we are focusing efforts on generating an initial design for experimentation. Such a design must begin somewhere. Koschmann *et al.* (1996) suggest that instructional innovations should be informed from the outset by some model of learning and instruction. In view of the fact that the field of professional education has been moving away from traditional didactic methods towards more contemporary approaches to adult learning, a suitable model for our design, therefore, is one that is based on social constructivist and situated learning theories. Problem-based learning (PBL) is a good example of such a model (Duffy & Savery, 1994). This was one of the reasons

why PBL was selected as the model on which to base on initial design. It was also selected because it is a well-established method in health and social care education, and because it is a preferred method of instruction in most interprofessional programs (Barr, 2003). Ideally, a design developed in preparation for design experimentation should draw from prior research (Cobb et al., 2003). However, little is currently known about the role of PBL in IPE or how its critical components can best be enacted to support IPE objectives. In the following sections of this review, these questions and the ideas and concepts used in this thesis are elaborated beginning with a description of IPE. Then, some of the key literature on PBL and simulations in interprofessional healthcare education is presented. Finally, activity theory is suggested and described as a conceptual toolkit for doing design-based research to inform the initial and future development of HEALTHSIMNET.

2.2 An Overview of Interprofessional Education

Due to the complex nature of health and social care in today's society, it is becoming increasingly important that health and social care professionals are able to work together effectively to meet patients needs (Barr, 1988). However, many barriers exist. A major barrier, as Ginsburg & Tregunno (2005) point out, are the strong professional cultures that hinder realization of effective and widespread collaborative practice. Historically, health professions have been established to function as specialized groups, each with their own assumptions, beliefs, identities, and practices that constrain the ways that they interpret and act on problems (D'Amour et al., 2005; Oandasan & Reeves, 2005). This has led to many cultural developments that collectively work against effective interprofessional collaboration, including the formation of rigid professional boundaries (Glen & Leiba, 2002), and the presence of stereotypes (Hind et al., 2003) and limited knowledge about other roles due to the isolating of professions during training (Reese & Sontag, 2001; Drinka & Clark, 2000).

Interprofessional education (IPE) is considered an important strategy to overcome these barriers (WHO, 1988). There is widespread belief that by providing opportunities for different and complementary professions to learn together, they will discover the value of working collaboratively (Barr, 2003). However, a scientific evidence base for interprofessional education has not yet been established (de Bere, 2003; Zwarenstein et al., 1999). On the one hand, there are quality studies that suggest IPE can lead to positive outcomes (Freeth et al., 2002). On the other hand, a systematic evaluation of many of these studies using the review guidelines specified by the Cochrane Collaboration, an international organization concerned with promoting evidence-

based practice, found no “rigorous quantitative research” on the effects of interprofessional education (Zwarenstein et al., 1999). However, they point out that the absence of evidence to show that interprofessional education is effective in terms of changing professional practice should not be interpreted to mean that it is ineffective (p. 422). Zwarenstein and colleagues are also careful to point out the quantitative bias of their review and suggest the need for more qualitative studies to “inform our understanding of underlying meanings, experiences, and explanations of IPE” (Zwarenstein et al., 1999, p. 423).

2.2.1 Expectations for IPE

Interprofessional education consists of several expectations. Barr (2003, p. 266) notes seven general expectations for interprofessional education:

- To modify reciprocal attitudes
- To establish common values, knowledge, and skills
- To build teams
- To solve problems
- To respond to community needs
- To change practice
- To change professions

Modifying attitudes and perceptions is the expectation that interprofessional initiatives will attempt to overcome resistance to collaboration by dealing with existing professional prejudices, stereotypes, and ignorance. While this expectation is an implicit goal of most interprofessional programs, many initiatives deal with modifying attitudes and perceptions explicitly. Early interprofessional initiatives attempted to address this expectation by providing opportunities for “rewarding interactions between students” (p. 267), but there is currently no conclusive evidence for the efficacy of such approaches. Several earlier initiatives were also directed at reinforcing common values, knowledge, and skills, but such approaches have been criticized for their overemphasis on commonalities to the detriment of professional differences (Barr, 1998).

Change-based initiatives are also present, but are more common at the post-qualification level. The majority of these are continuous quality improvement-based (CQI), which are programs which involve professionals learning how to identify problems and to make system improvements in real service settings (Stagnaro-Green et al., 1999; Briscoe & Arthur, 1998;

Headrick et al., 1995). CQI and other change-based approaches are considered by some to be a good starting point for a collaborative curriculum because it has been shown to have the most direct and positive impact on changing practice (Barr, 2000; Stagnaro-Green et al., 1999; Briscoe & Arthur, 1998). However, because such approaches are field-based, opportunities for this type of learning are constrained due to resource and logistical challenges (Barr, 2003). Likewise, community-based initiatives aim to improve the quality of services for underserved communities, but opportunities are also constrained due to a limited number of suitable placements (p. 274).

2.2.2 Competency-based outcomes for IPE

Many early interprofessional initiatives focused on outcomes that were “knowledge-based” or “attitude-based” (Barr, 1998), meaning that instructional emphasis was placed on eliminating prejudices, stereotypes, and ignorance. However, the modern healthcare workplace requires practitioners who are not only knowledgeable, but who also can continually learn, solve complex and unfamiliar problems, and can work effectively with others to achieve quality outcomes (Hmelo & Evensen, 2000). For this reason, there is increasing demand from employers and educators for a competency-based model of IPE that can prepare pre-service professionals for the challenges of the changing workplace. A competency-based model for IPE is also seen as a way to promote IPE integration with existing professional programs, which are predominately competency-based (Barr, 2000). According to Barr (1998), a competency-based model for interprofessional education should be able to prepare professionals to:

- Contribute to the development of knowledge and practice of others;
- Enable practitioners and agencies to work collaboratively to improve the effectiveness of services;
- Develop, sustain, and evaluate collaborative approaches to achieving objectives;
- Contribute to the joint planning, implementation, monitoring and review of care interventions for groups;
- Coordinate an interdisciplinary team to meet individuals’ assessed needs;
- Provide assessment services on individuals’ needs so that others can take action;
- Evaluate the outcomes of another practitioner’s assessment and care planning process;

(Barr, 1998, p. 183)

This revised view of learning outcomes has led many educators to rethink the ways that they prepare pre-service professionals for practice. Influenced by constructivist (e.g., Bruner,

1986) and sociocultural theories (e.g. Lave & Wenger, 1991; Vygotsky, 1978) of learning and instruction, increasingly, educators are looking to methods that actively engage students in the process of knowledge discovery and that allow learners to play a central role in their development of skills for collaborative practice and life-long learning. Currently, there are a number of IPE approaches that match this description. Barr (2002, p. 19) classifies the most popular interactive approaches into five categories.

Exchange-based learning involves a diverse group of professionals participating in a number of learning activities, such as games, debates, and case studies designed to allow participants to exchange views and to expose differences and similarities in professional perceptions, attitudes, and practices.

Observation-based learning commonly involves observation and assessment of other professions in real practice with the opportunity to provide feedback and to compare perceptions and views in an instructor-facilitated setting.

Simulation-based learning focuses on mostly non-computer-based role-play in contrived situations that allow groups of participants to explore relationships between different professions, to apply knowledge, and to develop clinical skills. This category also encompasses computer-based simulation and a variety of different types of games for learning.

Practice-based learning, places students of one profession with working practitioners from others to learn about different roles and professional cultures in the context of real practice. Training wards are a popular form of practice-based learning. In these settings, practice teams, consisting of students from different professions, learn together by collaborating on day-to-day operations. However, resource and logistical challenges commonly constrain widespread offerings of such opportunities.

Action-based learning includes both classroom-based and work-based learning methods. Barr cites continuous quality improvement (CQI) as one work-based example in which learners from different professions collaborate to improve the quality of services in real practice settings. PBL is a classroom-based example. In contrast to CQI, the focus in PBL is on resolving knowledge gaps with regard to addressing patient issues rather than process and organizational issues. Moreover, the aim of PBL is to promote clinical reasoning skills, problem-specific knowledge, and collaboration, whereas CQI-based opportunities enable participants to develop skills for affecting change. Together, these approaches are complementary; they target developmental areas that are essential for interprofessional practice.

This classification, however, should not be construed as an indication of clear distinctions between these various approaches. In many implementations, categories overlap, are intertwined, and often combined. One approach that epitomizes this point is PBL; and for this reason, it has become a preferred instructional approach in the field of IPE (Barr, 2002, 2003). Yet, despite its popularity, there is limited knowledge about how to enact the critical components of PBL to achieve IPE objectives. Consequently, there is little to inform our multimedia simulation design. This was one of the reasons why a PBL implementation within an interprofessional learning environment was chosen as the object of our pilot study. That is, to gain an understanding of how to enact the critical components of PBL to provide interprofessional learning opportunities using a multimedia simulation approach.

2.3 PBL for Interprofessional Education

Underpinned by principles of constructivist (e.g., Duffy & Jonassen, 1992; Bruner, 1986) and social theories of learning and instruction (e.g., Lave, 1988; Vygotsky, 1978), the majority of healthcare education programs offer authentic learning environments that encourage active and self-directed learning. One of the more popular approaches is PBL, a student-centred and action-based approach that originated in medical education (Bligh, 1999). PBL offers a number of advantages over traditional didactic approaches. In PBL, learning activity revolves around a realistic ill-structured problem. Unlike didactic instruction, where teachers direct learning, PBL involves student-led learning. In other words, they are responsible for identifying and addressing both individual and group knowledge deficiencies. Rather than being told what they should learn, they decide for themselves what the goals of the activity should be and what they need to learn in order to achieve those goals. Allowing for and enabling this type of self-directed learning within a realistic problem space is suggested as a necessary condition for nurturing effective problem solvers and life-long learners (Dolmans & Schmidt, 2000). In addition, PBL offers authentic cognitive challenges that help to prepare learners for the cognitive demands of future work (Duffy & Savery, 1994).

Rather than a specific teaching method, PBL refers to a general approach that features the following common elements (Zimmerman & Lebeau, 2000; Bligh, 1999):

- A complex problem case
- A structured learning process
- Self-directed learning
- Facilitation
- Small collaborative group learning

How these critical elements are enacted varies according to a number of contextual factors. Educational objectives, resource constraints, and types of learners are just a few of the factors that influence how PBL is implemented. For this reason, PBL has many variations and designing for PBL necessitates a sufficient understanding of the contexts for which it will be implemented.

Historically, PBL has been associated with professional development, used in a wide number of disciplines to assist learners develop scientific knowledge, clinical reasoning skills, and to promote effective collaboration. Because of its popularity in professional education, an increasing number of educators are adopting it as a means to promote interprofessional learning (Barr, 2003). There are at least three reasons for its appeal. First, the principles that underpin the conventional PBL model are consonant with current constructivist and social theories of effective educational practice (Koschmann et al., 1996). Second, PBL is a well-established approach in the domain of healthcare education. It is intuitive because its general workings are familiar to both learners and instructors. Third, because PBL involves interactive group-based enquiry, it is a logical means for facilitating interprofessional learning. Moreover, PBL allows educators to integrate both professional and interprofessional education under a single approach, thereby helping to mitigate the problem of accommodation within the already crowded professional curriculum (Barrett, Greenwood, & Ross, 2003; Vanclay, 1997).

Yet, very little is known about how to effectively apply PBL to realize this goal. Because of its historical roots in medical education, it is possible that there are residual factors that could hinder realization of IPE objectives. For instance, Yamada & Maskarinec (2004) suggest that the biomedical bias in conventional problem cases poses potential barriers to holistic learning and practice. This is one reason to heed de Bere's (2003) advice against automatic assumptions that any interprofessional approach necessarily leads to desirable learning outcomes. Collins, Joseph, & Bielaczyc (2004) point out that any evidence of an approach's effectiveness in one setting is no guarantee that it will be effective in other. Moreover, Brown & Campione (1996) warn about

“lethal mutations”, which refer to the problem of design enactments that undermine the principles that underlie the original design (Collins, Joseph, & Bielaczyc, 2004, p. 17). In light of these issues, it is important that we investigate how to effectively enact these elements for the purposes of IPE. Looking to the current IPE literature offers few useful answers. That is because the majority of studies on methods for IPE used summative evaluation methods to test the value of IPE. In other words, these studies focused primarily on exploring questions of efficacy rather than refinement.

The few studies that examined PBL in the context of interprofessional education offered few practical insights for instructional improvement. For instance, in a study on ‘multiprofessional’ PBL conducted by Lary *et al.* (1997) used a before and after study and a survey questionnaire to measure student satisfaction rates. Although the study found the majority of learners’ experiences to be positive, they did not provide useful insights to guide the design of critical pedagogical elements (e.g. problem cases, facilitation, tools for inquiry, etc.) or on the influence of these elements on learning outcomes. In another study, Hughes & Lucas (1997) measured student perceptions on whether the objectives of multiprofessional education and PBL had been met, on tutor performance, and on the quality of the working problems. Like the previous study, they found that the majority of participants agreed that multiprofessional objectives were achieved with PBL. However, they also noted a decline in the satisfaction rate in comparison to a similar study conducted in the previous year. They implicated group size, facilitator experience, course duration, and the adequacy of the working problems for activating students’ prior knowledge as possible explanations for this change. Their explanations were, however, derived from a survey designed to investigate satisfaction rates rather than from situated observations of actual learning activity. Because of this, it not exactly known which particular elements of the design affected satisfaction rates. In a more recent study, Solomon, Salvatori, & Guenter (2003) study, asked students to reflect on their learning experience and, at the end of the course, to rate their perceptions of the amount of personal learning that had taken place. The Reynolds (2003) study looked at gender differences in interprofessional PBL. This study found the differences to be non-substantial, but overall, like previous studies, they found that the majority of students responded positively to interprofessional learning with PBL. However, like previous studies, this one focused on overall outcomes rather than learning as a mediated process.

Whereas it appears that these studies focused on describing the overall effects of the existing learning activity, the ongoing aim of the HEALTHSIMNET project is to employ design in the service of investigating how to make improvements to the PBL process and its outcomes. As

an initial step toward achieving this aim, the pilot study reported in this thesis was designed to help generate a preliminary set of design hypotheses that can be tested in future cycles of design experimentation. Applying an activity theory-based method for analysis, the goal of the study was to identify structural tensions that manifested themselves as problems in PBL activity. Findings from this study will inform our knowledge about how to enact particular PBL elements in our simulation design in a way that adds educational value to the learning activity.

2.4 Simulations for Interprofessional Learning, Why Bother?

It is widely recognized that experiential learning can be an effective strategy for increasing learner development in complex and ill structured domains (e.g., Kriz, 2003; Kolb & Lewis, 1986; Kolb, 1984). In these contexts, learning with simulations is one way to produce gains in knowledge and skills development in ways that would be difficult to achieve using solely traditional didactic methods. Simulations are interactive learning tools that imitate some physical or social aspect of reality. The purpose of simulation is to assist learners in achieving understanding about and predicting the behaviour of complex systems (Simon, 1969). Simon also points out that although simulations are often linked to computers, they can also take the form of a “thought experiment” or a model of a physical system, such as a wind tunnel or a medical consultation room (p. 14). Gredler (2004) suggests four important characteristics for simulations.

1. They provide an adequate model of complex real-world situations. Rules that constrain actions and produce consequences reflect authentic casual or relational processes.
2. Participants have defined roles with responsibilities and constraints.
3. Feedback is provided in the form of a change in the problem or the environment

(Gredler, 2004, p. 571)

In addition, simulations are open-ended. Rather than being determined ahead of time, consequences are calculated according to a set of pre-specified rules and the current state of relevant actors and the environment. However, Gredler points out that this is a necessary, but not sufficient condition for a simulation. The essential requirement is “the experience of functioning in a bona fide role and encountering the consequences of one’s actions in the execution of that role” (Gredler, 2004, p. 573). For example, a user taking on the role of a family physician in a simulation should expect to possess the abilities and authority necessary to carry out medical tasks. In addition, a user playing that role in a simulation should also expect the same type of

consequences that a real practitioner might face if he or she fails to fulfil certain role responsibilities.

Gredler suggests that simulations can benefit learning and instruction in three ways. First, they help to bridge the gap between conventional classroom learning and the real world by providing opportunities to explore complex and evolving problems. Second, they help to reveal learner misconceptions. Third, they can reveal learners' problem solving strategies. Barach, Satish, & Streufert (2001) suggest that simulations can be used to evaluate performance. They also suggest that adding debriefing sessions following simulation supported learning also offers opportunities to explore learner's "salient preconceptions and emotions, which would otherwise be very difficult to assess" (p. 149). In addition, because simulations model some aspect of reality, they have the potential to provide authentic cognitive experiences and thus provide a way for participants to make sense of complex and abstract ideas (Duffy & Jonassen, 1992; Brown, Collins & Duguid, 1989).

Because of these and several other advantages, simulations have been, and continue to be, used in a wide variety of domains to support educational objectives by expanding possibilities for learning and instruction (Aldrich, 2004). Simulations are especially popular in medication education (Ziv et al., 2003; Barach, Satish, & Streufert, 2001; Lane, Slavin, & Ziv, 2001) and are used in some interprofessional programs to help learners to develop requisite skills for effective collaborative practice. One example is a simulated ward environment that provides opportunities for learning how to work with other professions (see Ker, Mole, & Bradley, 2003) Another application involves the use of simulated patients to allow medical and nursing students learn to work together to break bad news (see Wakefield, Cooke, & Boggis, 2003). The use of simulated patients in contrived scenarios has also been used to allow multiple professions to improve communication skills (see Donovan, Hutchison, Kelly, 2003).

There appear to be many good reasons to use simulation to support learning and instruction. We believe that with multimedia simulation, learners will have access to learning opportunities that may not be possible or difficult to provide via traditional classroom-based methods. However, in order to proceed with development, we first need to gain an understanding about the learning and instructional needs of the learning environment for which the simulation will be designed. Koschmann *et al.*, (1996) point out the instructional technologies are often designed to exploit the capabilities of a technology rather designed to meeting needs of the learning environment. Failing to meet these needs is one of the key reasons why many technological innovations fail.

In this study, activity theory was chosen as the main conceptual framework for helping to identify learning and instructional needs in an interprofessional-based PBL environment. Activity theory is a conceptual toolkit (Engeström, 1999b) that can be applied to help produce explanations for structural and pedagogical problems in learning activity. In this manner, activity theory can help to illuminate particular PBL components in need of improvement. Improvements to a particular PBL design can be made by refining existing mediating components or by introducing new components into the activity. Because the goal of the HEALTHSIMNET project is to explore the potential of multimedia simulation for interprofessional learning, the improvements suggested in this thesis will be based primarily on the application of a computer-based simulation for augmenting interprofessional PBL. As previously implied, activity theory plays a significant role in helping to inform current and future directions for simulation design. Thus, in the next section, activity theory will be explained, including its constitutive principles and some examples of how it has been applied in one field of research to inform systemic improvements. This introduction is intended to help set the groundwork for a description of a qualitative method for activity system analysis that will be presented in the next chapter.

2.5 Activity Theory as a Framework for Analysis and Design

Cultural-historical activity theory (CHAT), or activity theory for short, is not a theory in conventional terms, but a conceptual framework consisting of a toolkit of concepts and principles with which to understand the culturally mediated and goal-oriented practices of human actors. This introduction to activity theory begins with a historical overview followed by a description of the framework and finally, a presentation of how activity theory has been used to support the improvement of activity systems.

2.5.1 Historical overview

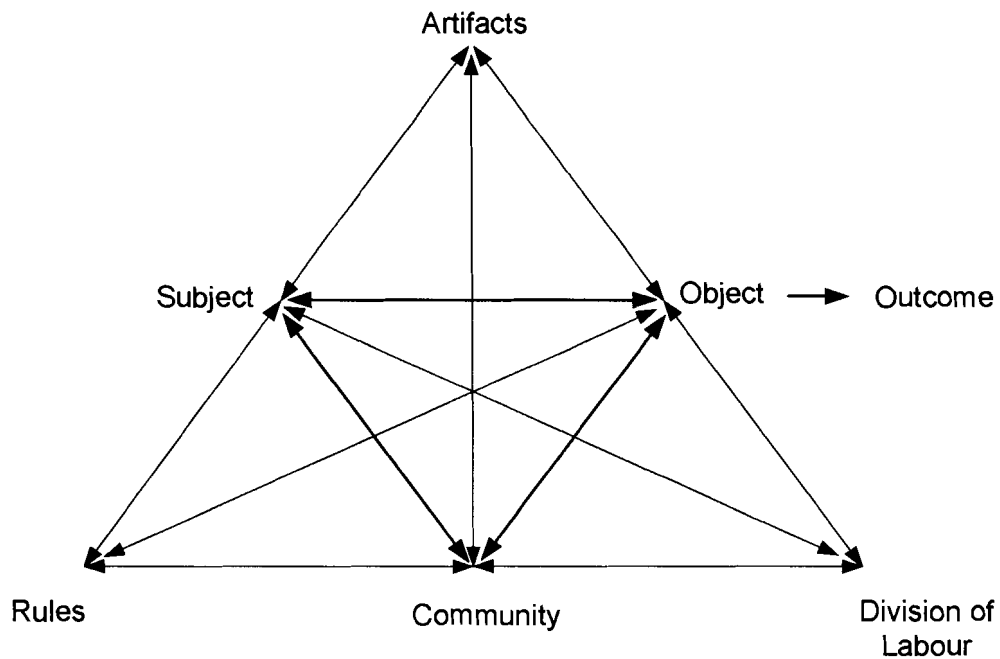
The impetus towards activity theory originated in the early half of the twentieth century with the work of Russian psychologist, Vygotsky (1978) and was later developed by his colleague, Leont'ev (1978). Their theory grew out of work that set out to develop a new socially inspired psychology that could transcend the prevailing psychologies of the time (Engeström, 1987). The initial framework centred on Vygotsky's principle of *tool mediation*, which he reasoned was the basic model for all higher psychological processes (Vygotsky, 1978, p. 39-40). In contrast to the prevailing behaviourist psychology of the current time, which modelled basic human action as a direct connection between stimulus (S) and response (R), he suggested that the

simplest form of conscious behaviour was a to be found in tool or sign-mediated action. In other words, conscious human action directed at transforming and object, which refers to a raw material or problem space (Engeström, 1990), is mediated by a historically and culturally influenced cognitive or material artefact. Thus, the famous stimulus-response dyad was transcended by a 'complex mediated act' now commonly expressed as the triad between subject, object, and mediated artefact (Engeström, 2001). Engeström (p. 134) summarizes Vygotsky's foundational contribution to activity theory as follows:

“The insertion of cultural artefacts into human actions was revolutionary in that the basic unit of analysis now overcame the split between the Cartesian individual and the untouchable societal structure. The individual could no longer be understood without his or her cultural means; and the society could no longer be understood without the agency of individuals who use and produce artefacts. This meant that objects ceased to be just raw material for the formation of logical operations in the subject as they were for Piaget. Objects became cultural entities and the object-orientedness of action became the key to understanding human psyche.”

Following Vygotsky's death, Leont'ev assumed a primary role in developing the conceptual framework that would later become known as activity theory. He made several significant contributions to the framework, among these were: differentiating between internal and external activities; a hierarchical structure describing three levels of activity; an explication of the crucial differences between individual action and collective activity; and several others (Engeström, 1987; Leont'ev, 1978). It was not until several years later that Engeström (1987) conceptually expanded Vygotsky's original depiction of individual culturally mediated action with Leont'ev's collective activity schema

Figure 2.1 The structure of a human activity system



Based on Engeström, 1987, after Leont'ev, 1978, Vygotsky, 1978

Figure 2.1 illustrates a new model of activity that incorporates the collective nature of human activity in social contexts. This new model transcends the old by making explicit the socio-cultural dimensions that constitute the mediating role of the community. In this model, analysis is conducted from the point of view of an individual or group (subject) (Engeström, 1990). The 'raw material' or 'problem space' (object) at which the subject's actions are directed is mediated by cognitive or material instruments (tools) in collaboration with other participants who share the same general object (community of practice). The social roles (division of labour), refers to both hierarchical power divisions and lateral division of tasks between members of the community. Finally, the conventions and procedures (rules) are what shape and constrain the actions and interactions within the activity system (p. 79). Leont'ev (1978) pointed out that these dimensions together inseparably constitute the minimal meaningful context, or the basic unit of analysis for understanding human activity.

2.5.2 Basic principles of activity theory

Over the last few decades, activity theory has developed into a widespread international movement, penetrating such diverse and overlapping areas as developmental research (e.g. Cole

& Engeström, 1993; Engeström, 1990) and human computer interaction (HCI) and computer supported collaborative work (CSCW) (e.g. Fjeld et al., 2002; Nardi, 1996; Kaptelinin, 1996; Bødker, 1989;) in Europe, North America and abroad. Within each of these areas, activity theorists are guided by varying sets of grounding principles that reflect the specific area of research interest. The five principles presented below are based on the description suggested by Kaptelinin (1996). Together, these principles constitute the basic theoretical framework common across the prominent application areas of activity theory-based research.

2.5.2.1 Activity is object-oriented

Object-orientedness refers to a subject's motive for activity. Human activity takes place in an objective reality that is socially and culturally defined by the subject. All such activity targets some existing raw material or problem space. In medical work, the object is the patient (Engeström, 1990). All goal-directed actions made by individuals and groups are thus fundamentally motivated by their conception of the patient. In this example, the problem space is the patient's illness. Actions and operations in medical consultation and treatment are directed at preventative, curative, and management of some medical condition. Leont'ev (1978) made the point that activities are distinguished from one another by their objects.

Separate concrete types of activity may differ among themselves according to various characteristics: according to their form, according to the methods of carrying them out, according to their emotional intensity, according to their time and space requirements, according to their physiological mechanisms, etc. The main thing that distinguishes one activity from another, however, is the difference of their objects. It is exactly the object of activity that gives it a determined direction. According to the terminology I have proposed, the object of activity is its true motive.

Leont'ev, 1978, p. 62

Moreover, activity necessitates an object. There is no such thing as an object-less activity (p. 63). Engeström (1999b) adds that object, or one's interpretation of it, is what "determines the horizon of possible actions" (p. 381). However, as aptly characterized by the term "horizon", the object is elusive. In other words, the object cannot be fully realized. Only goals are ever achievable, but embedded in every goal is an object that gives rise to it (Engeström, 1999b). For our purposes, what this implies is that all learning activity is driven by some motive that is manifested as a set of goals. Thus, in our study, as we observe students' learning, it is critical for

understanding the activity that we not only identify its mediating components, but also goals or motives at which the activity is directed.

2.5.2.2 Activity is hierarchical

Leont'ev (1978) reasoned that activity could be deconstructed into three distinct levels. At the highest level is the concept of *activity*, which is a collection of actions related by a single motive. At the "intermediate" level are *actions* that are aroused by the motive (Kuutti, 1996). Actions are goal-oriented processes that are necessary to fulfil the motive. Actions have clear beginning and end points and are relatively short lived, whereas activity is a continually evolving process with a start point that is difficult to trace (Engeström, 1999b). Around any given motive, there can be multiple actions that arise.

For example, in social work, the motive for activity is the client. For meeting the needs of the client, there can be several actions that may be related to meeting client needs. For example, making an application for social housing support is an action taken by a social worker that is motivated by the needs of a homeless client. As pointed out by Leont'ev, some actions are more indirect. For example, the design of a housing application form by a government agent is an indirect action oriented towards the goal of creating a formal document sufficient for assessment. However, the action is ultimately motivated by the needs of a homeless client even if the application form is not used directly by the agent herself.

At the lowest level of the hierarchy are the semi-automatic processes known as *operations*. These refer to the means by which actions can be achieved. In other words, whereas actions are related to goals, operations are related to conditions under which those goals can be achieved (Leont'ev, 1978, p. 65). Additionally, actions can become operations when they become a routine part of everyday practice. Conversely, operations can become actions when new conditions impede previously routinized practices. Continuing with our example from social work, the action of making an application for social housing support consists of a set of standard operations that entail collecting the client's identifying and financial information, checking for qualification, and submitting the form to the proper agency department. However, if the application process were to change, the social worker would need to become more conscious of the new requirements for social housing support. Her previous operations would become actions to which she must invest time and effort to comprehend the new conditions for acquiring support.

2.5.2.3 Internalization and externalization

Activity theory differentiates between internal and external activity. Internal activity corresponds to cognitive notions of mental processes that cannot be fully understood if examined separately from external activity (Leont'ev, 1978). This perspective is in contrast to the traditional Cartesian view of the human psyche (Leont'ev, 1978, p. 61), which Barab & Duffy (1999) articulate as follows:

Cartesianism is grounded in a set of dualisms that separate individual from environment and lead to the belief that knowledge refers to a self-sufficient immaterial substance that can be understood independently from the individual, environment, and context in which it is situated.

(Barab & Duffy, 1999, p. 349-350)

Vygotsky (1978) reasoned the transitioning between external to internal activity, or internalization, and between internal to external, referred to as externalization, formed the very basis of mental processes. Although Piaget had also employed the concept of internalization in previous work, the key differentiation was that internalization, according to Vygotsky, was social by its very nature (Kaptelinin, 1996). Kaptelinin, Nardi, & Macaulay (1999) illustrate these intertwined concepts with the example of the simple calculation, which, in the early stages of development may involve the learning of how to use fingers to count by observing others. Over time, the internalization of this operation leads to calculations in the head without external aids. Inversely, internal mental processes can manifest themselves into new external instruments.

2.5.2.4 Mediation

Vygotsky (1978) reasoned that the relationship between subject and object is not direct, as previously posited by exponents of behaviourism. Rather, activity is mediated by cultural tools. In activity theory, tools can be broadly interpreted to include either material instruments such as hammers, dictionaries, patient history records, and care agreements as well as cognitive tools such as a mnemonic or a heuristic. Kaptelinin, Nardi, & Macaulay (1999) explain that *mediation* plays a central role in activity theory because of its emphasis on social factors that shape and regulate human interactions. Furthermore, the affordances of a tool (Norman, 2002) reflect the cultural historical accumulation and transmission of social knowledge. Kaptelinin, Nardi, & Macaulay (1999) also point out that tools influence both external behaviour and internal mental functioning (p. 32).

However, the concept of mediation also extends to the collective dimension of the activity system, which comprises the community of practice and the rules and division of labour. In the same way that cultural tools mediate between subject and object, subject and object are also mediated by the rules of the community and by the division of labour implied by collective activity. Cole & Engeström (1993) state this point as follows:

...the relations between subject and community are mediated, on the one hand, by the group's full collection of "mediating artefacts" and, on the other hand by "rules" (the norms and sanctions that specify and regulate the expected correct procedures and acceptable interactions among the participants). Communities, in turn, imply a "division of labour," the continuously negotiated distribution of tasks, powers, and responsibilities among the participants of the activity system.

(Cole & Engeström, 1993, p. 7)

The principle of mediation can be applied to understanding the organization of medical work. For example, in the task of treating an HIV positive patient for symptoms, the object of prescribing an anti-retroviral (ARV) regimen is mediated at one stage of the process by the physician's prescription form, which is a tool that has evolved over time to both support decision making and to reflect the requirements of medical prescription and fulfilment. Additionally, this activity must include the hospital pharmacist who becomes part of the physician's community by way of the specific action of prescribing medication. The convention for this action may be the guidelines for completing the prescription form as well as the specific combination of medications and supplements that must be tailored to both the patient's biological profile and lifestyle. Furthermore, the relationship between the physician and the pharmacist in this activity implies a division of labour: the physician is responsible for determining the right combination of medications and the pharmacist is responsible for filling the right prescription.

2.5.2.5 Development of activity

Kaptelinin, Nardi, and Macaulay (1999) point out that activity theory considers all practices as influenced by historical developments. Put another way, practices, and their mediational means, represent socially constructed solutions to historical tensions in human activity. Thereby, according to Kaptelinin (1996), to understand activity "means to know how it developed into its existing form" (p. 109). Engeström (1999b) adds that understanding how to change activity involves knowing the relationships between its mediational components and to other activity systems. In this way, development is not only the target of study; it is also the reason for doing activity theory research (Kaptelinin, Nardi, and Macaulay, 1999). Thus, activity

theory based research is oriented towards transforming an existing practice. Thus, it is an approach not only for clarifying or describing existing practices, but also for informing some aspect of its development.

Kaptelinin, Nardi, & Macaulay (1999) point out that these principles reflect two basic animating concepts for activity theory:

- The human mind emerges, exists, and can only be understood with the context of human interaction with the world.
- These interactions that constitute *activity* are socially and culturally determined.

(Kaptelinin, Nardi, & Macaulay, 1999, p. 28)

These ideas suggest that activity is socially mediated. For activity theory-based research, this implies a commitment to studying activity as it happens in its natural context. In this way, activity theory-based research is an approach that considers the entirety of a particular activity system (see Figure 2.1) as the basic unit of analysis. Moreover, in addition to producing rich descriptions and explanations of activity and outcomes, activity theory-based research is fundamentally oriented toward applying such descriptions and explanations to inform system refinement. Put another way, the findings and theories produced through activity-based research should be capable of doing “real design work” in helping to generate, select, and validate design alternatives (diSessa & Cobb, 2004, p. 80). What these points and the examples that follow suggest about our research is that, by using activity theory, we are making a commitment to advancing the development of a particular learning environment using an interventionist approach that has been shown to be effective for informing system improvement.

2.5.3 Applying activity theory for the improvement of systems

Engeström (1993) points out that activity theory does not have ready-made methods, but provides conceptual tools that need to be “concretized” according to the needs of the object of study. In this way, activity theory is a versatile framework that can be adapted for a variety of settings to study human activity.

Activity theory is often used to not just to describe activity systems, but as an explanatory construct (diSessa & Cobb, 2004, p. 78) that can be used to inform their improvement. Yrjö Engeström is one researcher who is well known for his work in applying activity theory to guide the development of healthcare activity systems. In his ongoing work, activity theory is the

primary conceptual tool in a participatory and interventionist methodology called *developmental work research* (Engeström, 1993), which is close methodological relative of design-based research. In many of Engeström's studies, activity theory was used to guide discovery of systemic contradictions and tensions in healthcare work that manifested themselves as problems affecting the quality of care.

In one application area, activity theory was used to help explain deficiencies in medical diagnosis and treatment in a Finnish medical clinic (Engeström, 1995). Through analysis of conversation data of interactions between physician and patients, it was found that health clinic physicians were often inaccurately diagnosing medical complaints. However, instead of focusing on the problem at the level of physicians' knowledge and skill, a systemic analysis was conducted, revealing the cause of the problem to be a particular organizational rule governing medical consultations that sometimes prevented accurate diagnosis and effective treatment. In this clinic, one of the rules governing walk-in cases stipulated that, in order to minimize wait times, only a patient's primary medical complaint could be dealt with. For whatever reasons, in some cases, patients acted according to this "single problem rule", but physicians did not. In other cases, patients violated the rule, but physicians obeyed the rule. In these cases, the apparent discoordination between physicians and patients prevented an accurate diagnosis because other possible causes of patient complaints (e.g. psychological, social, other biomedical conditions) could not be fully explored. Using an activity theoretic analysis, the source of these discoordinations was traced back to the "single problem rule" that govern medical consultations. Using this finding as a working hypothesis, redesign efforts focused on finding ways to resolve the issues presented by the single problem rule in light of its original purpose.

In another case, activity theory helped to illuminate structural contradictions in children's health care, which led to the collaborative construction of a new coordinating instrument for improving the management of care trajectories (Engeström, 2001). This effort was prompted by two related problems in the health region under study. First, due to the rising cost of healthcare services in Finland, there was a political effort to reduce the excessive use of high-cost services. This pressure was especially directed at hospitals, such as the Children's hospital in Helsinki, since they tended not to encourage patients to use lower-cost primary care services. These pressures eventually motivated new divisions of labour that favoured primary care services over hospital care. However, this led to a second problem. Because of these changes, patient care became decentralized. Engeström suggests that this was especially burdensome for families with children affected by multiple or unclear diagnosis because they often drifted between care

providers without any one having overall responsibility for managing the care trajectory. In response to this problem, sixty representatives, consisting of nurses, physicians, and management staff from primary care clinics and hospitals responsible for the care of children in the Helsinki health region, assembled to “collaboratively redesign” the system of coordination between health providers. Over ten meetings, activity theory was used by the facilitators to show how the instruments used for coordinating care within institutions were incompatible with those of other complementary services and contradictory to the ways the patients actually used care services. This discovery gave the participants point of focus, and as a result, a new coordinating instrument was proposed that purported to resolve the limitations of the previous design. Engeström referred to this effort as an example of *expansive learning*, or a form of learning that leads to the progressive refinement of systems in which activity theory-based evaluation plays a critical role.

Activity theory has also been used to inform understanding of classroom learning. For example, Barab *et al.* (2002) used activity theory as a “theoretical lens as well as an analytical tool” for understanding “pervasive” tensions in an introductory course on astronomy (p. 104). Barab *et al.* point out that using activity theory allowed researchers to understand the complex dynamics of learning interaction within the classroom, which is in contrast to traditional experimental methods, which attempt to understand human interactions by isolating them out of the contexts where they naturally occur. As they suggest, viewing the classroom as a collection of interacting activity systems allowed them to illuminate particular “dualities”, such as the tension between “pre-specified teacher-centred instruction” and “emergent, student-directed learning” (p. 85), which led to “outcomes that were inconsistent with students developing astronomical understandings” (p. 104). Gaining a grounded understanding of how particular course components contributed to these outcomes was deemed an important step in the evolution of the learning activity.

In summary, activity theory is a conceptual framework that can be used to help researchers to generate descriptions and possible explanations for particular types of issues in human activity systems, including the mediational components therein, and to guide qualitative transformations of these systems of activity. As such, it is a theoretical tool that meets the design-based research criterion for an “ontological innovation” that is capable of doing “real design work” (diSessa & Cobb, 2004, p. 77). However, activity theory not an established methodology, but a conceptual framework without ready-made methods. Engeström (1993) points out that its conceptual instruments must be concretized for the particular needs of a study. In this study, which seeks to illuminate structural tensions in PBL activity and to use potential findings to

inform the design of HEALTHSIMNET, grounded theory techniques were used to provide a methodological structure for activity theory-based analysis. In the next chapter, I describe this method in greater detail and suggest how it can be used to reveal structural tensions in learning activity.

3.0 METHODS

Activity theory suggests that human activity systems are not stable and harmonious entities. They develop over time and behind this development are the structural tensions that emerge within and between the components of interacting activity systems (Engeström, 1990). This study was based on this premise. That is, to varying degrees of effect, structural tensions exist in all activity systems and are opportunities for development. However, there is no generally agreed upon method for illuminating tensions in an activity system. Some of the best examples for illuminating structural tensions and contradictions in human activity employed activity theory as part of the discovery process (e.g. Huotari, 2003; Barab et al. 2002; Engeström, 1999a; Engeström, 1995). Even so, each study differed in terms of its methodological design. In this study, a method was conceived that employed grounded theory coding techniques to systematize the illumination process. Using this method, this study sought to illuminate tensions in the activity of learners and to use potential findings to inform the design of HEALTHSIMNET and possibly to generate questions for future research. This chapter begins with a description of the setting where the study took place. Then details are provided about what data were collected and how they were collected and triangulated. Finally, a description is presented of the method that was conceived to illuminate tensions from the collected data.

3.1 Description of the Course

The course that is the object of our design research is an undergraduate interprofessional course called *IHHS 402 - HIV/AIDS Prevention and Care*. It is an elective course offered to senior undergraduates by the College of Health Disciplines at the University of British Columbia (UBC). Established in accord with the British Columbia University Act (1970 updated 2000), the College of Health Disciplines is a collaborative academic unit supporting interprofessional and interdisciplinary education between the health and human service programs (HHSPs) at UBC. These includes Audiology, Speech-Language Pathology, Clinical Psychology, Counselling Psychology, Dental Hygiene, Dentistry, Food, Nutrition and Health, Human Kinetics, Medicine, Nursing, Occupational Therapy, Pharmaceutical Sciences, Physical Therapy, and Social Work and Family Studies (Gilbert & Bainbridge, 2003, p.288).

This is currently one of eleven courses currently offered in the College's interprofessional program. This particular course was chosen as the object of study for three primary reasons. First, it has one of the highest levels of professional diversity in the interprofessional health science program at UBC. Second, the course focuses on the topic of HIV/AIDS, a complex domain of practice highly relevant to IPE. Lastly, it offered a convenient timeframe within which to conduct the research study.

The overarching goal of the course was to prepare students in the health and human service professions to begin practice in the field of HIV/AIDS as members of an interprofessional team. It hoped to achieve this by bringing together a diverse group of pre-service professionals to learn with and about each other. Course objectives consisted of two interrelated categories: a set of learning objectives for interprofessional education and one for HIV/AIDS prevention and care.

Table 3.1 IHHS 402 course objectives

Interprofessional Objectives
<ol style="list-style-type: none"> 1. Understand the roles and responsibilities of members of interprofessional teams. 2. Understand concepts basic to effective interprofessional teamwork. 3. Explore personal and professional values and beliefs as they relate to interprofessional teamwork. 4. Build, maintain, and evaluate the collaborative process as members of an interprofessional student team. 5. Value partnership between the interprofessional team and individuals living with HIV.
HIV/AIDS Prevention and Care Objectives
<ol style="list-style-type: none"> 1. Know characteristics of the human immunodeficiency virus and its effect on the immune system. 2. Understand the epidemiology of HIV and AIDS. 3. Recognize the links between social determinants of health and prevailing social policies relevant to HIV and AIDS. 4. Examine prevention strategies. 5. Explore approaches to care, treatment, and support of individuals living with HIV. 6. Demonstrate knowledge of community resources specific to the needs of persons living with HIV. 7. Explore personal and professional values, beliefs, and attitudes as they relate to HIV infection. 8. Examine physical, psychosocial, and spiritual issues confronting individuals at risk for, infected by and affected by HIV. 9. Explore the role of advocacy in relation to HIV/AIDS prevention, care, treatment, and support.

IHHS 402 course, Summer 2005, HIV/AIDS Prevention and Care course objectives, by permission of Irene Goldstone

The intensive four-week course took place at Providence Health Care (PHC) at St. Paul's Hospital, a major teaching, research, and HIV referral hospital in downtown Vancouver. The course consisted of a (1) theoretical component delivered as lectures, guest presentations, and workshops, (2) a student-centred learning component delivered as PBL, (3) a clinical placement component supported by the various partnering hospital departments and local community agencies providing HIV/AIDS health and social care, and (4) a project-based component, requiring students to produce a final presentation that described how they worked as a team to address the health and social care needs of their patient. For this last component, PBL was used as a means for students to discover their own scientific knowledge deficiencies and to learn about the roles and responsibilities of members of an interprofessional team.

3.2 The PBL Design

In the course, a total of five PBL meetings took place over a four-week period. Each of the six interprofessional teams was assigned a unique problem case to manage. Problem cases were divided into five sequential scenarios, each representing a phase in the chronic illness trajectory (Corbin & Strauss, 1992) for HIV/AIDS. Together these scenarios formed a linear fictional narrative about a patient's life with HIV/AIDS from time of diagnosis to the end stage of illness. One scenario was presented at each PBL meeting, so teams did not know in advance how the patient's illness would unfold. The first scenario summarized some of the patient's social and medical history. Subsequent scenarios presented the patient's current health status along with a series of questions intended to focus problem solving to pertinent issues. Meetings lasted approximately one and a half hours in which students discussed each of the questions, inquired about case facts, formulated hypothesis, identified learning issues, and divided research tasks. In addition to supporting discussions about HIV/AIDS-related issues, problem scenarios were also intended to guide production of a final group presentation in which they could show how they addressed their patient's health and social care needs.

Table 3.2 IHHS 402 PBL scenario

Description
Jason B. is a 24 yr old Caucasian, gay man with bipolar disorder who recently broke up with his partner. Following a 2-month hypomanic episode, he has entered a depressive time and today you find him in need of support.
Questions
<p>Discuss the vulnerabilities of your patient. How is he marginalized by society?</p> <ul style="list-style-type: none"> • What recent event in Jason's life makes him vulnerable? • How might his mental illness contribute to his vulnerabilities? • How would other aspects of his lifestyle, his housing situation, social network, and socio-economic status influence his behaviour and activities? • How is he marginalized by society and what effect might this have on his decisions and behaviour? • How might Jason be at risk for contracting HIV? What may protect him from seroconverting? • What information should be provided when raising the issue of testing? • What should be addressed during the pre-test counselling session?

IHHS 402 course, Summer 2005, HIV/AIDS Prevention and Care PBL scenario, by permission of instructor, Irene Goldstone

3.3 About the Pilot Case Study

The pilot case study focused on one interprofessional team of undergraduate students. The purpose of the study was to illuminate structural tensions in PBL activity. Findings from the study will be used to inform future directions for HEALTHSIMNET research and design. The study was designed to help answer the following questions:

- What are the breakdowns and discoordinations in PBL activity in an interprofessional course about HIV/AIDS prevention and care?
- How did these breakdowns and discoordinations affect interprofessional learning?
- Were structural tensions the source of these breakdowns and discoordinations and if so, what were they?

3.4 Participant Recruitment for the Pilot Case Study

The case study focused one PBL team. Thus, the goal of recruitment was to gain consent from all members of a single team rather than individuals from different teams. In total, there were 29 students enrolled in the course divided into 6 teams consisting of approximately 5 learners each. The five professions represented in the course were social work, nutrition, nursing, medicine, and pharmacy. Also enrolled were two students from the interdisciplinary program at UBC. Teams were formed by the instructors prior to the commencement of the course, consisting of one student from each profession and a tutor.

To make the case study tractable, only two teams were recruited; one team to be the object of both observation and interviews, and the other to provide a second set of perspectives that would be gathered only through interviews. Recruitment for the study began prior to the commencement of the course. An email was broadcasted to enrolled students informing them of the study. On the first day of the course, I was invited to make a presentation to the class about the general goals of the study and its procedures. Each student also was given with an introduction letter that detailed the observation and interview procedures and a consent form. Students were asked to submit the consent form within two days if they wanted to participate in the study. The following information was provided to students:

- This study is completely voluntary and you may withdraw at any time without affecting your current or future standing in the course.
- Each team must unanimously agree to participate in the study.

- Only the first two teams that provide unanimous consent would be considered for inclusion.
- You have up to two days to read, sign, and submit your consent form.

Consent forms were collected on the third day of class. Two teams unanimously consented to the terms of the study. Both teams had five members. TEAM A consisted of a registered nurse, a medical student, a nutrition (dietetics) student, a pharmacy student, and a social work student. TEAM B consisted of one interdisciplinary student, a medical student, a nutrition student, a pharmacy student, and a social work student. TEAM A was selected for the case study because it had representation for each of the five health and social care professions. However, TEAM B was included as part of the triangulation strategy (Stake, 1995).

3.5 Data Collection & Triangulation

The case study data were collected over a four-week period using three methods: analysis of course artefacts, non-participant observations (Bouma & Ling, 2004), and semi-structured interviews. The course artefacts, which were the course schedule and the problem cases, were examined to generate a description of objectives, rules, and assessment guidelines for the course. Non-participant observation was used to document what was happening in three PBL meetings, with attention paid to the problems that emerged. Following the procedure for grounded theory-based research, observation data were analyzed shortly after each meeting (Corbin & Strauss, 1990). During this preliminary analysis, categories of problem issues were developed that were later verified in interviews with study participants.

Triangulation data were collected through semi-structured interviews with members of TEAM A and TEAM B. Triangulation is a way to verify findings in qualitative research (Stake, 1995). It involves the inclusion of two or more methods of data collection that allow for richer and fuller descriptions of human behaviour (Cohen, Manion, & Morrison, 2000). In this study, triangulation entailed the use of semi-structured interviews to verify and corroborate provisional hypotheses generated during preliminary analysis of observation data. Interviews with study participants also provided different perspectives on provisional findings and allowed for new discoveries.

3.5.1 Analysis of course artefacts

Two instructional artefacts were collected for analysis: the course schedule and the “problem-based learning student case”. Analysis of these artefacts was ongoing. These artefacts

were of interest because they were tools that mediated the learning process. The course schedule listed the presentations, workshops, clinical placements, PBL sessions, and the required readings for each day. In addition, it provided a description of course objectives, some assessment guidelines, learning activities, and deliverables. These artefacts were important for the study because activity theory-based design research necessitates the inclusion of the tools in analysis of an activity.

3.5.2 Non-participant observation

Due to scheduling challenges, data collection through observations was limited to the last three PBL meetings. Formal data collection began with the third of five PBL meetings. TEAM A conducted all three meetings in vacant meeting rooms adjacent to the main classroom where the other teams met to work on their cases. Each member of TEAM A sat facing each other as they discussed the problem scenarios while I sat to the side, away from the team, but close enough to hear the proceedings.

Team discussions were manually recorded. Some notes were also taken that described the use of course artefacts and the actions of the participants. These meetings were not electronically recorded due to concerns over the potential obtrusiveness of recording devices on group interaction (Merriam, 1988). Instead, participants' utterances and actions were carefully recorded using a paper-based instrument for data collection.

3.5.2.1 Instrument for recording observations

The instrument for data recording was a simple 'on-site observer' form (Stake, 1995) containing four data fields: the time of an utterance (TIME), the role of the participant making the utterance (INITIATOR), a direct quotation or description of the utterance (QUOTATION), and notes about participant actions, the contextual details of the activity, and questions for further investigation (NOTES).

Table 3.3 Meta fields describing each utterance

Meta label	Purpose
Time	Recording the beginning of the event occurrence (HH:MM)
Initiator	Identifies the participant making the utterance by professional role
Quotation	A verbatim quotation and/or summary description of the utterance
Notes	For collecting information about participant actions and about the context of group activity. Also used to record questions for further investigation

A record was entered into the on site observer form for each utterance. For the majority of utterances recorded, all four categories were populated, however, at certain times, due to the rapid and occasionally overlapping nature of group discussions, recording a verbatim utterance was not possible, so quotes were supplemented by descriptions of utterances. In these instances, rather than recording the entire utterance, keywords that stood out were noted with information about the speaker. Merriam (1988) points out that capturing keywords from participant utterances is an acceptable method for faithfully accounting for the participant interactions. Further, recording keywords was necessary for the preliminary round of grounded theory analysis that took place after each meeting and subsequent rounds of analysis that took place after the course.

3.5.3 Semi-structured interviews

After each meeting, the observation data was analyzed for possible phenomena of special interest to this study. Findings in this preliminary round of analysis were provisional. Verification entailed interviewing the participants from TEAM A (n = 3) and TEAM B (n = 3) (Appendix B) who agreed to participate in the study. Questions were open-ended, allowing for variation in individual responses (Kvale, 1996). They focused on questions that generated during the collection of observation data and on issues illuminated through preliminary analysis of this data.

The responses of the six participants who agreed to be interviewed were electronically recorded and transcribed verbatim with clarifying or explanatory terms in parentheses. Three of the interview subjects, social work student, a nurse, and a nutrition student, were members of TEAM A, while the remaining three subjects, a medical student, a nutrition student, and a pharmacy student, were members of TEAM B (see Table 5). Interviews with members belonging

to two separate teams supported the data triangulation strategy by allowing me to ascertain whether a particular phenomenon or issue remained the same in another case (Stake, 1995).

Table 3.4 Interview participants

Team	Participant
TEAM A	Social work student
	Professional nurse
	Nutrition student
TEAM B	Medical student
	Pharmacy student
	Nutrition student

With the observation and interview data transcribed, a second round of modified version of grounded theory analysis was applied using an activity theory framework. The next section describes how these were used in conjunction during and after the study to illuminate sources of trouble in PBL activity.

3.6 Tools and Methods

3.6.1 Unit of analysis

Activity theory played a central role in this study. It provided a conceptual framework that helped to illuminate structural tensions in the activity system of learners. Using activity theory implies an ontological commitment to the entire cultural and historical activity system as the “minimal meaningful context” for analysis (Barab et al., 2001). In other words, the entire activity system (i.e., subject, tools, rules, divisions of labour, community, and object) is the basic unit of analysis. Collectively, these components contribute to the structuralizing of an activity, thus they constitute a strong influential force behind how activity unfolds. Examining these mediating components and their relationships is therefore a good way to help generate explanations for problems that emerge in an activity.

3.6.2 Tensions in activity

Activity systems are not perpetually stable and harmonious entities. Conflicts sometimes arise or exist between different components due to conditions that were unanticipated during its

design or problems that went unresolved over the course of its development. These conflicts, or *structural tensions*, can sometimes lead to the undermining of system goals, but they can also be the impetus for system learning and innovation (Dobson, LeBlanc, & Burgoyne, 2004; Engeström, 2000; Norros, 1996). Tensions manifest themselves as problems, misfits, disturbances, breakdowns, and discoordination within and between activity systems (Engeström, 1999a). A *contradiction* is a type of tension that describes the relationship between elements that are opposed or contrary to each other. In this thesis, the terms tension and contradiction are used interchangeably or together to refer to this type of relationship between interacting components within an activity system or between two or more activity systems.

Engeström (1987) distinguishes between four types of tensions: Primary, secondary, tertiary, and quaternary.

A *primary tension* refers to the dual nature of the mediating components of an activity system. In some components, there is tension between the use value and exchange value in each mediating component of an activity system. In some learning environments, students often face this tension in the production of course artefacts such as final projects. Constructing a final project has a dual purpose; not only is it a means for learning about how to deal with real world problems, but it is also an object that can be exchanged for merit (Barab et al., 2002).

A *secondary tension* occurs when particular components of an activity system are injected with a “strong novel factor” thereby acquiring a new quality (Engeström, 1990, p. 84). Such tensions arise between the new component and the existing components of the activity system. For example, when a heterogeneous community of professionals is introduced to a historically uni-professional model of instruction and given interprofessional practice objectives, there is likely to be tension between the new holistic approach that arises, and the rules, tools, and divisions of labour that were hallmarks of the old model.

A *tertiary tension* arises when a culturally more advanced motive (e.g. the belief that medical practice should be about empowering patients) is introduced into an existing activity system. The motive may be formally implemented, but they are also resisted by the exponents of the old activity.

Quaternary tensions occur because activity systems interpenetrate each another (Spinuzzi, 1999). For example, the activity system of a medical student interacting with the activity system of a social work student who are jointly working on a problem produced in the activity system of a course designer. Such an interaction is likely to result in tensions between

rules, division of labour, instruments, and goals because each system is shaped by cultural and historical differences in activity.

In this study, structural tensions are working hypotheses about the sources of trouble and difficulty originating from the mediating components of an activity system. In activity theory research, tensions are illuminated by looking for instances of problems that emerge in learning activity. A *problem* is a matter or situation that presents difficulty or a deviation from a desired state. Discoordinations can occur when there are misalignments between diverse elements in an activity. The previous chapter presented an example of a discoordination between physicians and patients in medical consultations that prevented accurate diagnosis of patient complaints. Engeström (1995) argues that diagnosis is a collaborative act between health practitioners and their patients. Where there is discoordination, or misalignments between stakeholder strategies or approaches, effective collaboration cannot occur, and thus accurate diagnosis cannot be made. In interprofessional work teams, discoordination between efforts to achieve a shared goal can lead to duplication in work, ineffective use of resources, difficulties in providing care, and potentially poor patient outcomes.

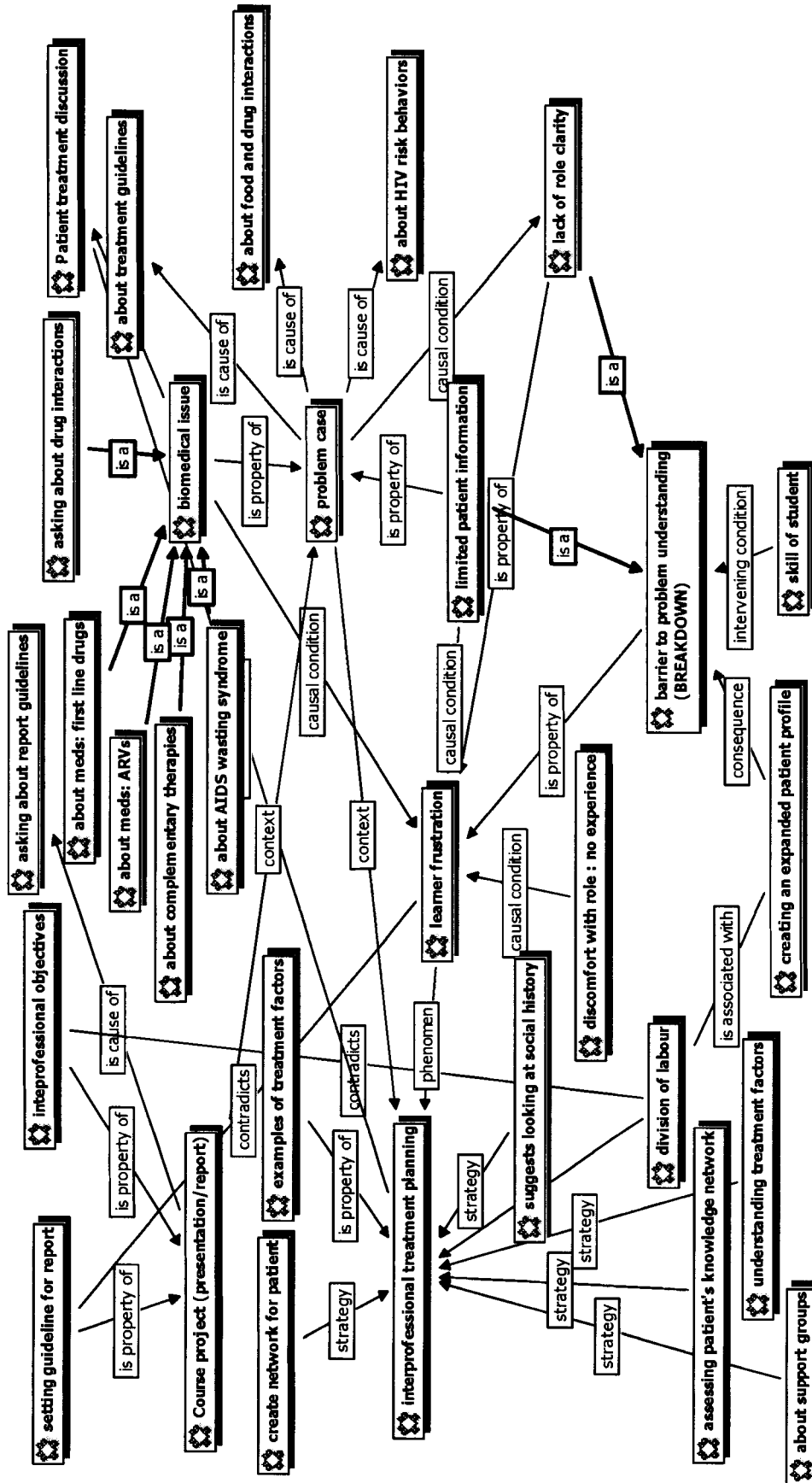
Another example of a problem is a breakdown. Breakdowns result when an action or an operation fails to produce a desired or anticipated outcome due to an unanticipated condition (Bødker, 1991). In learning activity, breakdowns can occur when there is a tension between the production goals of a student and the types of guidelines or resources made available by the course designers to achieve that goal. Breakdowns often lead to work stoppage and result in shifts to tangential actions. For example, suppose a nutrition student is engaged in a nutrition planning exercise in which she finds herself without the necessary height information to calculate the body mass index (BMI) score of a patient. As a result, she temporarily halts nutrition planning in order to notify her instructor about the missing information. In this example, a shift in action has occurred from calculating the patient's BMI score (operation) to acquiring the missing information from her instructor (action). The shift is an instance of a breakdown because the activity of nutrition planning is halted in order to pursue a tangential action. Breakdowns are sometimes planned outcomes of an instructional strategy, but they are more often symptoms of inherent structural issues in the learning design. In this sense, they are clues that can help to identify the sources of unintended or unimagined outcomes in PBL activity. During analysis, discovering breakdowns involved a process based on Bødker's (1996) technique for analyzing video of user interactions to look for focus shifts in students' actions. In particular, I looked for instances where students were unable to continue or participate in an activity (e.g., treatment

planning) due to inadequate means (e.g. rules, resources, division of labour, etc.). These examples are only two of several possible types of problems that could emerge as a result of structural tensions. In this study, analysis focused on events, situations, and outcomes that were inconsistent with students developing interprofessional understanding.

3.6.3 ATLAS.ti for qualitative analysis of data

A qualitative analysis tool called ATLAS.ti assisted in parts of the coding process. This software package enables researchers to apply a systematic approach to analyzing large bodies of unstructured data. In this study, ATLAS.ti assisted in the coding of observation and interview data. Figure 3.1 is an example network visualization of the codes and concepts used to describe the utterances in one PBL meeting.

Figure 3.1 A partial network view of relationships between indicators and concepts representing a discussion about treatment implications



3.6.4 Coding

Modified grounded theory coding techniques were applied to systematize the illumination of tensions using data collected from observations and interviews. This study however, is not a representative instance of the grounded theory methodology. By using an activity theory framework, this study is selective about the information of interest. In particular, this study is interested in looking for problems in the learning activity and in finding the structural sources of those problems.

Grounded theory is a qualitative research methodology that is used to generate theoretical explanations of phenomena on the basis of observable experiences (Corbin & Strauss, 1990). In ground theory research, theory generation from collected data proceeds through three iterative phases of discovery: (1) *open coding* to develop concepts, categories, and subcategories (2) *axial coding* to generate hypotheses by conducting intense analysis around one category at a time based on a “coding paradigm”, and (3) *selective coding* to relate categories to a central phenomenon in order to explicate the underlying storyline. Grounded theory research, however, does not prescribe a particular ontological framework for analysis; this must be provided by the researcher. The ontological framework used in this study is predicated on the activity theory notion of the activity system. It is therefore important to realize that by using this framework, this study is selective about the phenomena of interest, which are grounded structural explanations of illuminated problems with PBL activity. This is why the coding scheme of grounded theory research is used as opposed to any other. In the following sections, I describe how this coding scheme was used for the purposes of illuminating tensions in learning activity.

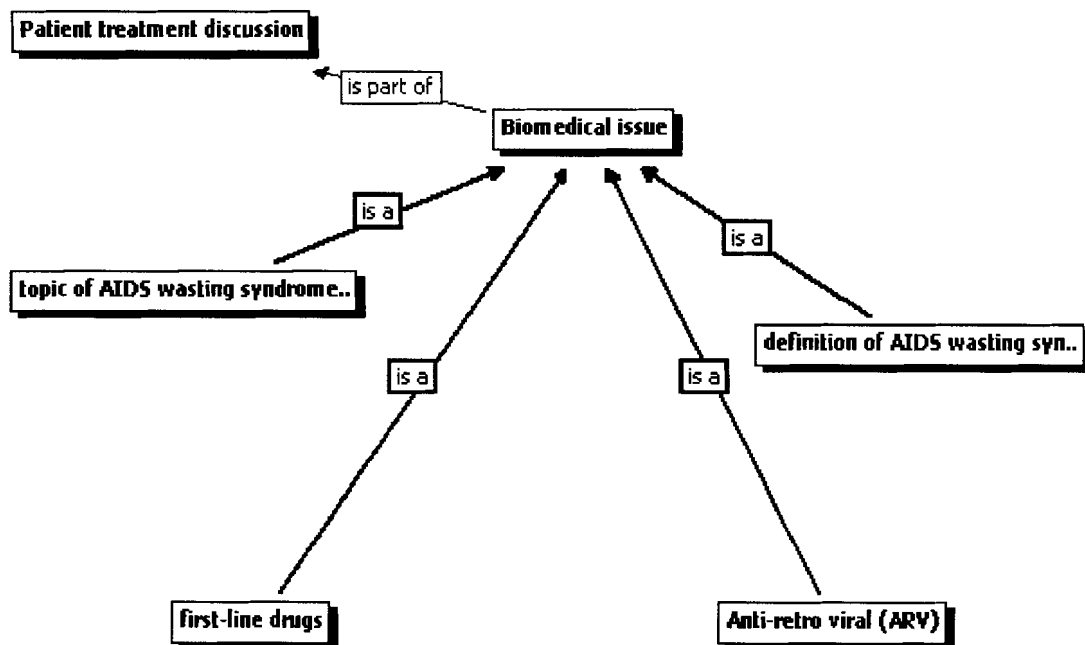
3.6.4.1 Open coding

In the initial phase of analysis, open coding was used to create *concepts* that describe actions in activity. According to Kuutti (1996), actions are goal-oriented and refer to what subjects are doing, whereas activities refer to a collection of actions that are related by a subject’s motives. The open coding process began with labelling the *issue at hand* for each recorded utterance. The issue at hand is the object of an action or discussion. The object can relate to any aspect of the overall activity. For example, a concept, process, or artefacts (Barab, Hay, Yamagata-Lynch, 2001). In most cases, labels for issues at hand were taken directly from the text. This is known as *in vivo* coding (Creswell, 1998).

Next, labels were compared against each other to identify similarities and variations. Concepts were developed to describe similar labels. For example, *AIDS wasting syndrome*, *first line drugs*, *anti-retroviral therapies*, *complementary therapies*, and *drug interactions* are some of the labels derived from the observation transcript. Labels that are associated with a concept are known as *indicators* (LaRossa, 2005; Strauss, 1987). For example, the concept “biomedical treatment issues”, or “biomedical issues” for short, was chosen to describe the indicators listed above. LaRossa (2005) suggests that concepts should be sufficiently abstract to describe the similarities between indicators. In this study, most concepts that were developed represented areas of professional concern. Thus, some of the other concepts used were: psychological, social, spiritual, and legal.

Once a concept has been identified, the data is revisited and other utterances are compared against the concept. If an utterance is determined to be accurately represented by the concept, it is added as an indicator. Otherwise, a new concept is generated to describe the utterance and in the following rounds of constant comparison, utterances are compared against both the old and newly generated categories. Opening coding ends when concepts are “saturated”, or “when a researcher [gets] to a point where addition of another indicator to those already grouped [does] not appear to generate significantly new insights about that concept” (LaRossa, 2005, p. 841).

Figure 3.2 Example of relating indicators to concepts in ATLAS.ti



3.6.4.2 Axial coding

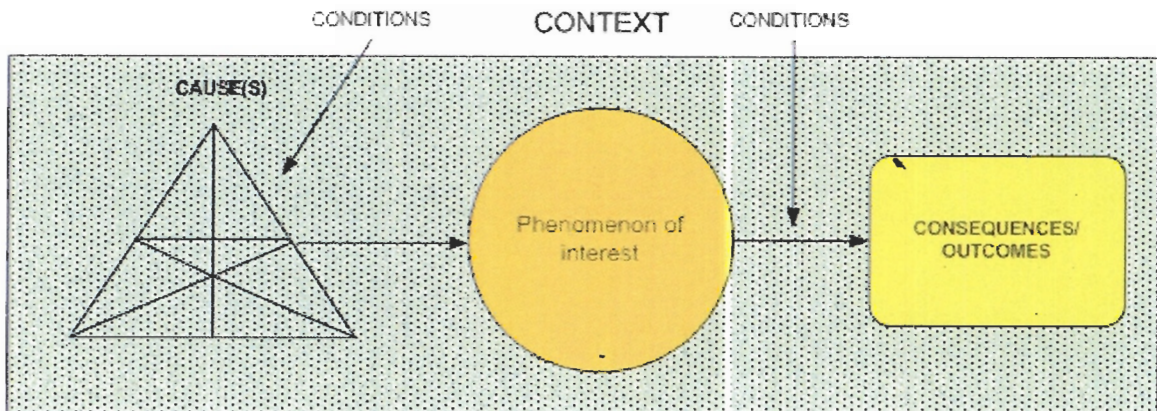
Axial coding involved examining a central concept or phenomenon of interest. This entailed creating, refining, and relating concepts to each other in order to find causal relationships. In grounded theory analysis, these relationships are built using a “coding paradigm” (Corbin & Strauss, 1990). The “Five C” coding paradigm used in this study that consisted of the following:

Figure 3.3 The “Five C” coding paradigm

Components	Description
Concept or phenomenon	What is the phenomenon of interest? <i>e.g. biomedically oriented discussion</i>
Context	Describe the context in which the phenomenon occurred <i>Note: In our research, this category includes the “conditions”. By doing activity theory-based research, we are examining how the contextual conditions influence the emergence of the phenomenon being studied.</i>
Conditions	What are the conditions that gave rise to the phenomenon? <i>e.g. The biomedically oriented problem scenario; team consists of mostly biomedically trained members; history of medical dominance; tutor is a physician and may have limited knowledge about the role of social work.</i>
Cause(s)	This aspect of the paradigm is closely related to “conditions”. However, the main difference is that the cause refers to the structural component(s), whereas the conditions refer to the nature of these components. These two aspects work hand-in-hand to describe the reason for the phenomenon’s occurrence.
Consequences/outcomes	What are the consequences or outcomes of the contextual conditions? <i>e.g. the conditions and events led to a complaint from the social work student about the overly biomedical focus and lack of collaboration</i>

After Corbin & Strauss, 1990

Figure 3.4 A “coding paradigm” for axial coding



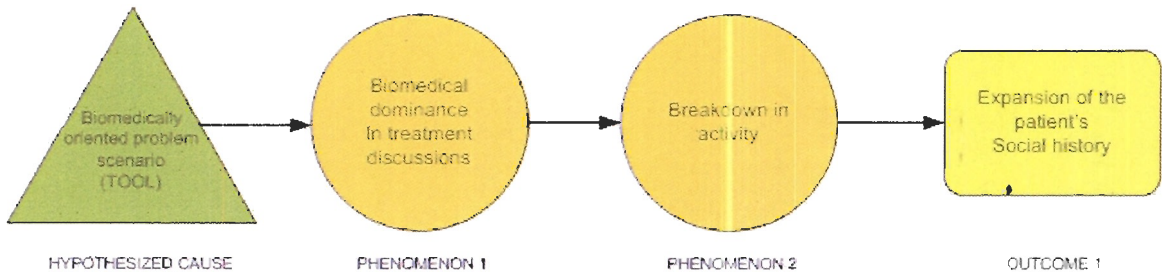
After LaRossa, 2005

In this study, axial coding began with an identification of a phenomenon of interest. The phenomenon was identified from the list of concepts that were generated during open coding. One phenomenon that was selected for further analysis was the biomedical discussions that occurred in the third PBL meeting. This became a phenomenon of interest because, despite the fact that the PBL activity was intended to foster discussions on a range of issues related to patient treatment, the majority of indicators from this meeting were associated with a biomedically-oriented discussion. This imbalance in treatment topics prompted further investigation on the causes and consequences of this phenomenon.

The second phase involved looking at the contextual conditions that gave rise to the phenomenon. This involved referring the tools that were used, team composition, the object of the activity, the rules governing the activity, and the divisions of labour. This was done in an effort to construct a representation of the activity system, with the phenomenon of interest as the outcome of the activity. The third phase overlapped with the second. In this phase, the structural causes of the phenomenon were hypothesized. These provisional hypotheses were generated by asking, which of the mediating components of the activity led to the occurrence of the phenomenon? These hypotheses were later corroborated in interviews with participants. In the fourth phase, the consequences or outcomes of the phenomenon were investigated. For example, the biomedically dominated discussions precipitated a breakdown in the treatment discussion. The breakdown that occurred was another phenomenon of interest, so further analysis was conducted using the same axial coding paradigm. This analysis revealed that the breakdown led to the production of a new patient social history. In this manner, axial coding allowed provisional relationships to be built

between concepts and for hypotheses to be generated about the structural cause of phenomena. Figure 3.5 illustrates these relationships based on the previous example.

Figure 3.5 Axial coding example



3.6.4.3 Selective coding

In grounded theory analysis, selective coding is the process of unifying concepts around a “core” category (Corbin & Strauss, 1990). According to Mullen & Reynolds (1994) core category is one that “accounts for most of the variation in a pattern of behaviour and which helps to integrate other categories that have been discovered in the data” (p. 129). LaRossa (2005) points out that selective coding is used to illuminate an underlying storyline that connect the various concepts developed during axial coding. In this study, selective coding was the process by which problems were unified under the structural tensions that caused them. During the axial coding phase, problems were traced back to their structural causes. For example, the breakdown in team discussions about treatment was traced to the mediating case instruments. During selective coding, problems that appeared to share a common structural cause were grouped together. This included bringing together concepts and indicators from the observation data as well corroborating evidence from the interviews and some course artefacts. These components were used to produce a descriptive account of specific problems that emerged during the PBL meetings and their structural causes. In this study, three descriptive accounts were developed. These descriptive accounts, which offer structural explanations for the illuminated problems in PBL activity and their outcomes, are presented in the next chapter.

Figure 3.6 Phases of data analysis

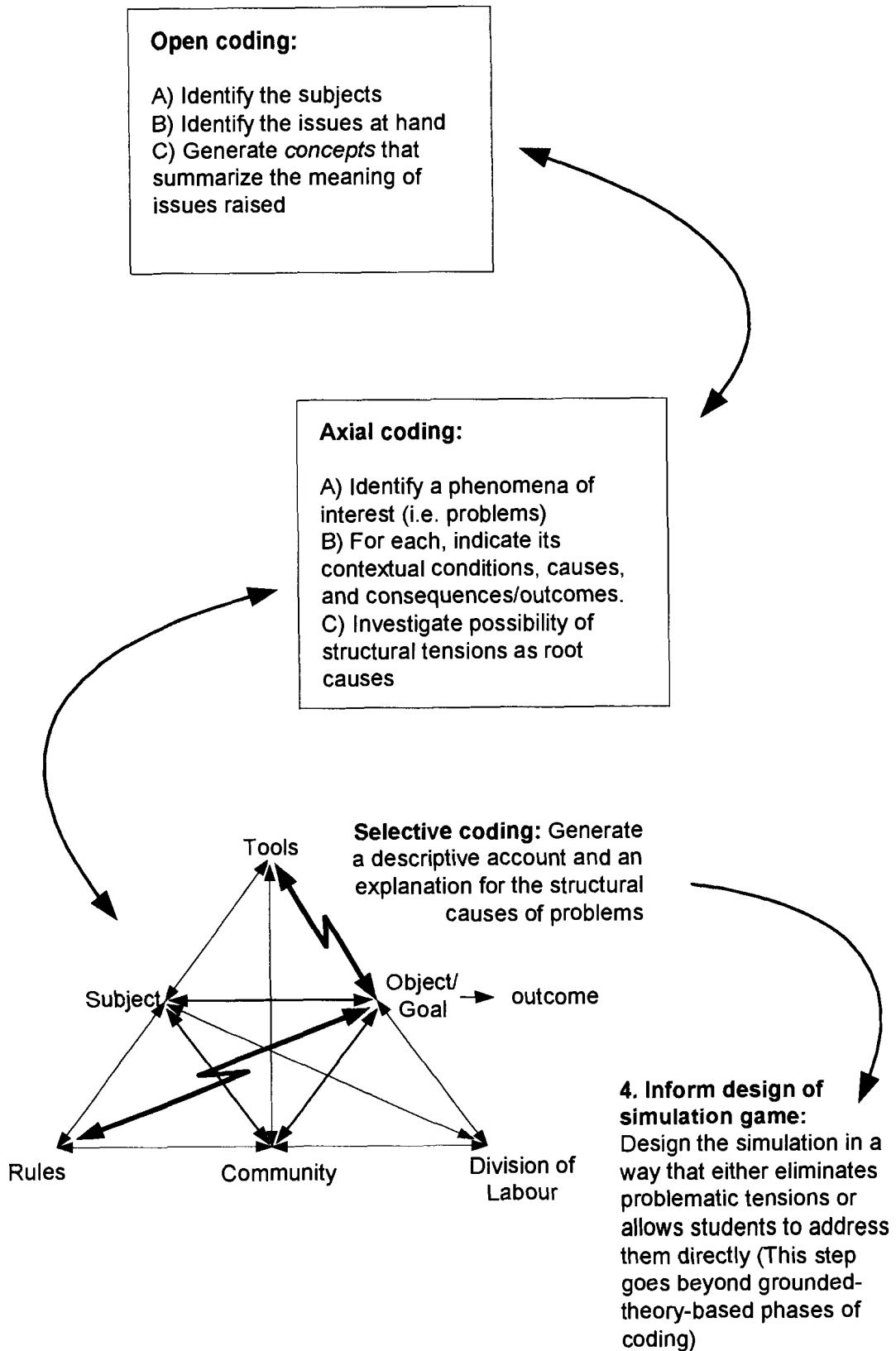
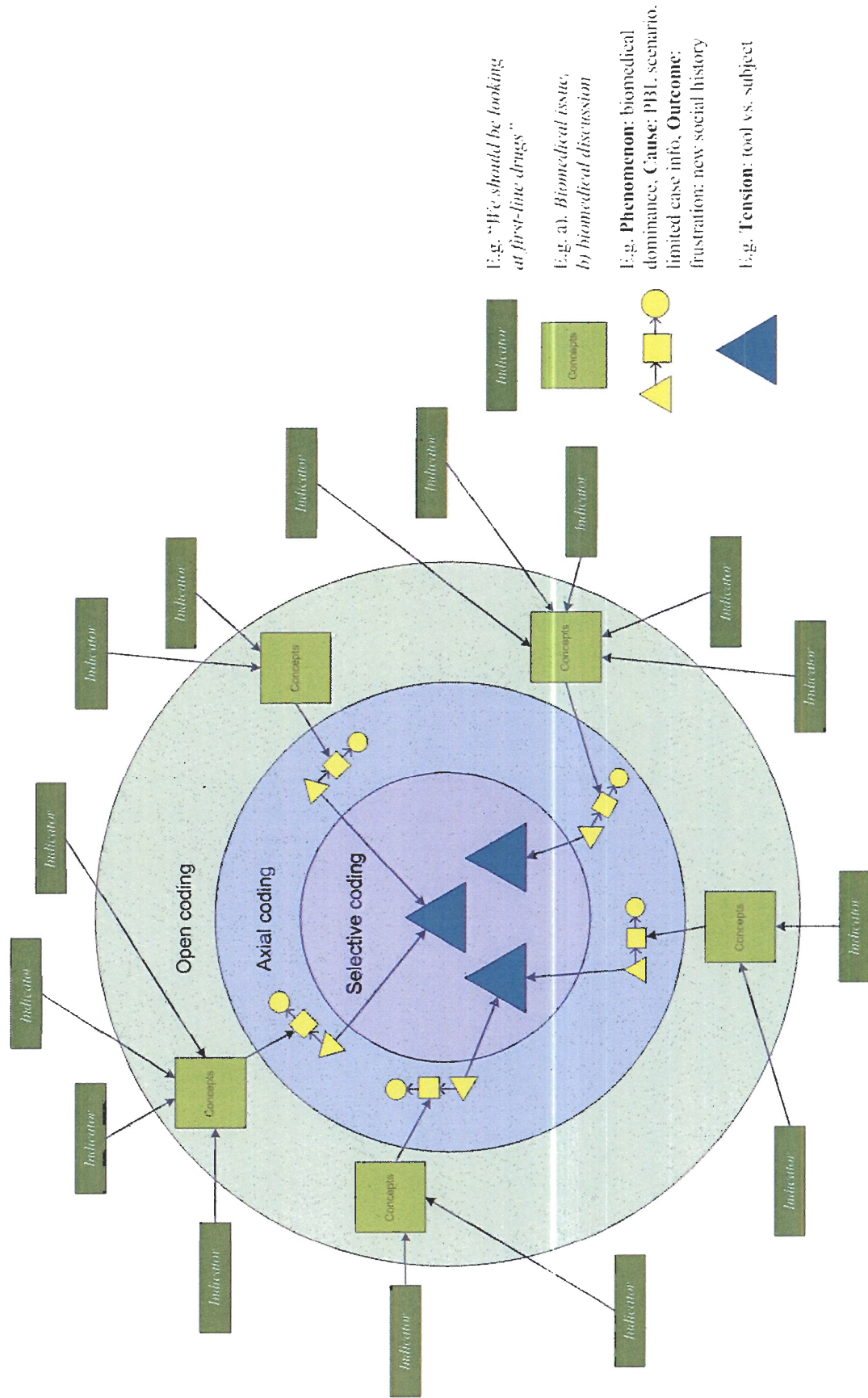


Figure 3.7 Illustration of the coding model



4.0 RESULTS & DISCUSSION

In this chapter, I suggest three sets of structural tensions illuminated from analysis of observation notes, interviews transcripts, and course artefacts. The presentation format is partly based on Engeström (1990) and Barab *et al.* (2002). Structural tensions were illuminated by looking for problem indicators in PBL activity. For the first two sets of hypothesized tensions, I posit that certain mediational components may have contributed to particular breakdowns and discoordinations in PBL. For the third hypothesized tension, I posit that certain deficiencies in the activity system constrained possibilities for learning about other primary and auxiliary roles in HIV/AIDS networks.

4.1 Overview of TEAM A's PBL meetings

At each PBL meeting, teams were provided with different ill-structured problem scenarios to discuss. The problem scenarios represented fragments of a larger illness narrative describing a HIV patient case from pre-diagnosis to the end stage of the illness. There were six patient cases in total, one for each team, and nine problem scenarios in each case. Teams were expected to consider patient issues and to discuss care strategies by drawing on information provided in each scenario and from the partly developed case history. They were encouraged to create their own information about the patient to meet practical needs. However, because scenarios were provided two at a time, teams did not know ahead of time how their patient's story would unfold. Because of this, students also did not know what specific types of patient information needed to be created until after receiving a problem scenario.

The first problem scenario was presented at the first PBL meeting. This scenario, which dealt with the pre-trajectory phase of the HIV/AIDS illness trajectory, provided some background information about the patient and a set of questions to guide group discussion. In all six cases, this information included the patient's gender, ethnicity, age, and his or her current condition. In some cases, it also included brief synopsis about the patient's family composition, psychological issues, and addiction issues. In the case of TEAM A, the following scenario and questions were presented at the first PBL meeting.

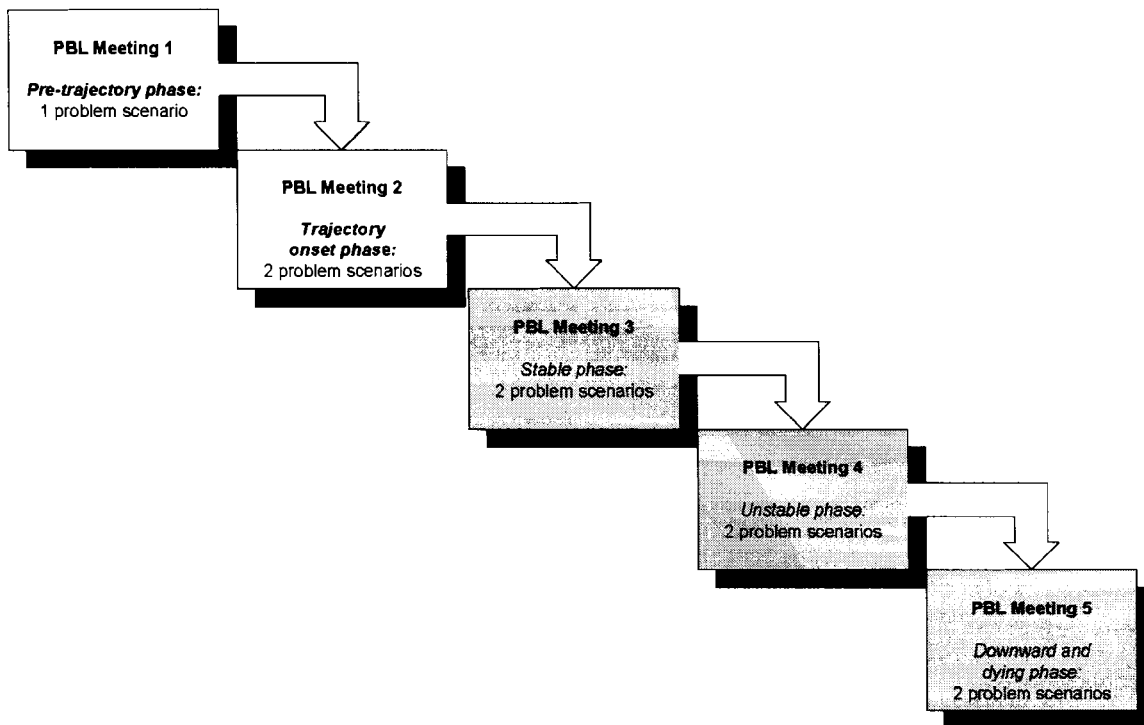
Table 4.1 IHHS 402 PBL scenario

Description
Jason B. is a 24 yr old Caucasian, gay man with bipolar disorder who recently broke up with his partner. Following a 2-month hypomanic episode, he has entered a depressive time and today you find him in need of support.
Questions
Discuss the vulnerabilities of your patient. How is he marginalized by society? <ul style="list-style-type: none">• What recent event in Jason's life makes him vulnerable?• How might his mental illness contribute to his vulnerabilities?• How would other aspects of his lifestyle, his housing situation, social network, and socio-economic status influence his behaviour and activities?• How is he marginalized by society and what effect might this have on his decisions and behaviour?• How might Jason be at risk for contracting HIV? What may protect him from seroconverting?• What information should be provided when raising the issue of testing?• What should be addressed during the pre-test counselling session?

IHHS 402 course, Summer 2005, HIV/AIDS Prevention and Care PBL scenario, by permission of instructor, Irene Goldstone

In each of the four meetings that followed, students were presented with two scenarios that followed a similar format to the one shown above. In the second meeting, students were provided with scenarios that dealt with the trajectory onset phase of the illness. In the third meeting, where the observation study began, scenarios were presented that dealt with the stable phase. In the fourth meeting, scenarios for the unstable phase were presented. In this meeting, a substitute tutor joined the team. In the final PBL meeting, the medical student was absent, so the remaining four students, facilitated by their original tutor, were presented with two problem scenarios in the downward and dying phase of AIDS.

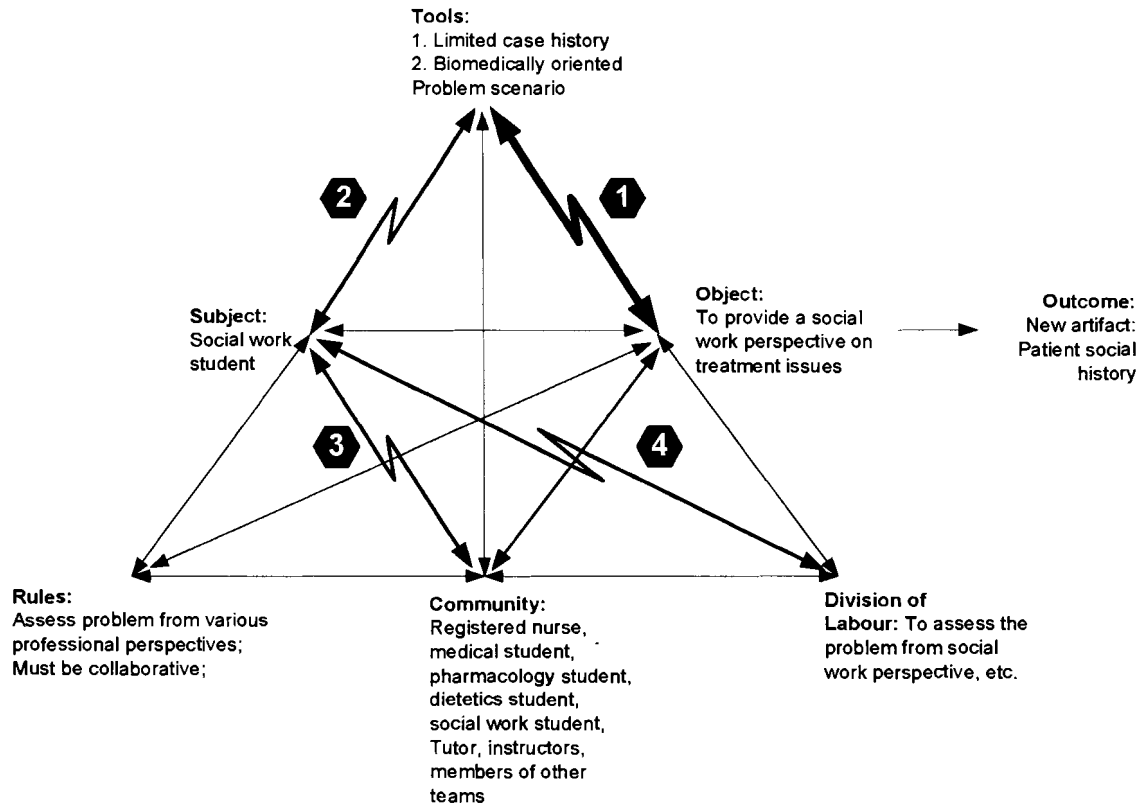
Figure 4.1 Overview of problem-based learning meetings



In the PBL meetings, students were encouraged to consider patient issues in general terms, but they were also required to concretize their ideas into viable patient-specific care interventions. In these meetings, students could talk about considerations for patient care in general, but because they were also required to prepare a final project, they also had to concretize those considerations into a description of how the team dealt with patient-specific issues at each stage of illness. This meant that students had to construct a medical, psychological, and social history, a history of the presenting illness (circumstances that led to the patient's hospitalization), and to propose treatment for their patient. In the following sections, I will discuss the findings from activity theory-based analysis of observation data that was collected over the last three PBL meetings.

4.2 Tensions in Activity I

Figure 4.2 Tensions between the object (providing a professional perspective) and the tools, community, and division of labour.



Each problem scenario consisted of some descriptive information about the patient followed by a series of questions to guide group discussion. Some of these scenarios appeared to be inclusive, meaning that they allowed all professions to contribute something to the group discourse. However, some scenarios were partly exclusive, meaning that they favoured a particular category of perspectives. Under these conditions, some professions were prevented from participating, which was contradictory to the purpose of the learning activity. This finding was first made in the third PBL meeting, where, contrary to the goal of supporting all professional viewpoints, the case information provided seemed to favour a mostly biomedical perspective (Figure 4.2, number 1). Because of this bias, there seemed to be no clear role for social work in the problem scenario (Figure 4.2, number 2). Other members of the learning community did not appear to be as affected by this bias. However, because the rest of the team had very little knowledge about the role of social work in this scenario (Figure 4.2, number 3), they were unable to help the social work student to fulfil her professional role (Figure 4.2, number 4). This

situation precipitated a breakdown in group activity and a shift in discussion from biomedical issues to talk about creating an expanded patient profile that could inform multiple forms of practice. What follows is a segmented account delineating the circumstances that led to this breakdown and its resolution.

At the third PBL meeting, activity begins with a round of review and research reporting. At line 19, the nutrition student presents the current day's illness chapter and initiates a discussion about AIDS wasting syndrome. At line 25 (Table 4.1), the nutrition student indicates that there is three years of medical information that is missing from the patient's profile that could be of value in generating treatment options. Because of this, she is unable to determine whether the patient's weight loss can be considered beneficial or detrimental to his health.

Table 4.2 Transcript excerpt displaying initial discussions in the third PBL meeting

Line	Participant	Action
19	Nutrition	<p>Presents the next chapter: "Day 3 – the stable phase"</p> <p>"Three years elapse and Jason has had routine monitoring. He suffered a bout of viral pneumonia 2 years ago but he has been otherwise well and his counts acceptable. Today, he has come to the team for a check-up.</p> <p>His CD4 count = 300cells/mm³ and VL > 100,000copies/mL. His weight has dropped to 73kg.</p> <p>What are the treatment implications?"</p>
20	Nutrition	Initiates discussion on the topic of AIDS wasting syndrome
21	Medicine	Attempts to help the nutrition student with definition of AIDS wasting syndrome
22	Pharmacy	Joins discussion about what constitutes AIDS wasting syndrome
23	Tutor	Asks team to define the AIDS wasting criteria
24	Nurse	Provides a technical definition of wasting
25	Nutrition	"There's three years of missing information...three years was a long time. Also, his weight at the beginning could have been considered obese..."
26	Tutor	Points out that there is a formal criteria for AIDS wasting syndrome and suggests it as a new learning issue
27	Pharmacy	Asks tutor for definition of an AIDS defining illness
28	Tutor	Lists and explains the four stages of illness

At line 29, the social work student joins the discussion for the first time. She suggests to the group that they should consider the patient's social history before formulating a treatment strategy. In response to her suggestion, the group shifts its focus from talk about AIDS defining illness to a short deliberation about the patient's social history. Following the discussion, the group comes to a consensus that a record of the patient's social history will be useful for treatment planning. However, the creation of this record is not adopted as a group task. Instead, it is treated as a separate non-priority work issue that is delegated to the social work student. The need for a social history is further downplayed when the tutor indicates at line 37 that the team only needs enough information to consider the treatment implications.

Table 4.3 Transcript excerpt showing a discussion about patient's social history

Line	Participant	Action
29	Social Work	"[we should] take a step back and look at his history. There is a high chance he has other issues...If we have a better profile of him, we can treat him better."
30	Social Work	Begins reading patient's existing profile out loud "Jason is 24; he recently broke up with his partner..."
31	Nurse	Agrees with social worker. Suggests that social work student be the one to lead the task of creating patient's social history
32	Tutor	Asks how patient's social history will affect his treatment
33	All	Team talks about the importance of social history in determining the best course of treatment. They come to an agreement that the patient's history will influence treatment decisions, so they propose that social worker take on task of constructing Jason's social profile.
34	Social Work	"I'm feeling uncomfortable with my role, having no background as a social worker..."
35	Nurse	(talking to the tutor) "Is there something you know that we don't know?"
36	Nutrition	Asks whether they will need a complete patient history for the final assignment.
37	Tutor	"No...It's not important that you construct the whole patient...We just need enough to talk about the considerations..."

In the following excerpt (Table 4.3), the discussion on treatment implications proceeds without a social history and without guidance on the role of social work in assessing and planning patient treatment. Because of this, the social work student is unable to contribute to the discussion despite questions being raised about the patient's social network (e.g., lines 43 and 45). She is

also does not respond to the nurse's suggestion (line 49) because she does not have enough patient information to suggest a compatible support group.

Table 4.4 Transcript excerpt displaying questions about the patients social history

Line	Participant	Action
38	Pharmacy	Asks whether the patient should be on ARVs
39	Nurse	Agrees that their patient should eventually go on ARVs
40	Pharmacy	Points out that they need to first inform their patient about the risks and benefits of ARVs
41	Medicine	Introduces concept of "first line drugs"
42	Pharmacy	Volunteers to get information about first line drugs
43	Nurse	"I want to know how well informed he has been..."
44	Medicine	Asks nurse why she thinks its relevant to know that information
45	Nurse	"i want to know if he has friends that have been on ARVs... No need to overreact at this point about resistance to ARVs...and liver issues"
46	Tutor	Asks the team whether they have considered the kinds of support groups that could help their patient understand treatment issues
47	All	Group points out that they have already talked about support groups
48	Tutor	"Your approach may be different because of the stage of the illness...If you push too hard, he may say to forget about it."
49	Nurse	"...maybe we connect him to people that have been on ARTs..."
50	Pharmacy	Points out that the team needs to first create list of things that they want to know about the patient

In the next segment (Table 4.4), another episode of the illness chapter is presented to the group. Again, the discussion takes on a predominately biomedical orientation with the exception of one remark at line 61 that provokes the social work student to verbalize her frustration in the subsequent line. At line 65, she restates her need for a social history as the meeting begins to draw to a close.

Table 4.5 A transcript excerpt showing the social work student verbalizing her frustration

Line	Participant	Action
51	Nutrition	Reads the next episode in the chapter "Jason has returned to the team and is adamant that he wants no 'Cocktail poison', only complementary therapies. He understands the potential ramifications of his low CD4 count, but he is only agreeable to taking his mood stabilizer, Epival (Valproic Acid) 1500mg at bedtime. He has decided to go the "natural route" because, as he says, "I'm concerned about my liver." What discussion do you have with him? How do you feel about his resistance to ART?"
52	Nurse	Suggests that they should investigate complementary therapies
53	Pharmacy	"I'll look up the drugs and their effect on the liver."
54	Nurse	Shares story about the effects of drugs on the liver
55	Nurse	Talks about considering complementary therapies
56	Tutor	Asks team to consider the course of action if the patient agrees to treatment
57	Nutrition	Points out she needs to know more about food and drug interactions (creates a learning issue)
58	Tutor	Suggests that team needs to know how to build therapeutic relationships
59	Tutor	"Consider similarities to his reactions to 'cocktail' poisons' that the rest of the population is also resistant to..."
60	Nutrition	Suggests that care providers get more out of developing a long term relationship with the patient
61	Tutor	"It's not clear on when to start therapy. It depends on the individual and where they're at. By pushing it, you might be creating a problem."
62	Social Work	"I feel that I can't get involved because [the discussions are] very medically oriented. I'm not sure what my role is...I'm interested in his mental state. I'm interested in his [social] history for this reason!"
63	Tutor	Addressing the social work student, he restates that she can take on the task of creating patient's social history
64	Nurse	Agrees that it is crucial to have a social history.
65	Social Work	"I feel that I can't do my job [without a social history of the patient]. I've been trained to have that information before I can do anything."
66	Tutor	Leads discussion to a close and asks team about next steps
67	Social Work	Reminds team that they need to create a report for the course, so they may need a good description of the patient
68	Social Work	"...So I'm going to make up Jason's social history...I need something to work with..."

At the fourth PBL meeting, the social work student attempts once again to draw the group's attention to the need for a social history, but this time she emphasizes that the task should be taken on as a group activity. Despite her suggestion, the discussion proceeds without any further mention of a social history (Table 4.5).

Table 4.6 A transcript excerpt displaying a team discussion about creating a social history

Line	Participant	Action
69	Nurse	"Has anyone been with their disciplines yet?"
70	Social Work	(Speaking to the nurse) "No. This has been more about the medical aspect..."
71	Nurse	"Would it help to make a (patient) history?"
72	Social Work	"Yes, but It should be a group discussion. It can be any profile...I need it so that I can have something to refer back to..."

From preliminary analysis of the observation data for the third PBL meeting, it appeared that source of the breakdown was the biomedically oriented problem scenario and insufficient patient case history. To corroborate this finding, an interview was conducted with the social work student from TEAM A. When she was asked for her perspective on the matter, she provided the following response.

I think during the PBLs it seemed as though from a social work standpoint that we were jumping the gun and going right into the medical side of things and meds and treatment, but without knowing our patient, and that is a big 'no-no' in social work. You have to know your patient and you have to develop a therapeutic relationship. You have to have several forms, bio, psycho, social, spiritual, and we were going right into the medical. I felt that when I had incorporated that into the PBL, it was just overlooked.

She also described how the situation led to personal confusion and frustration with regard to her own role in the problem scenario.

They were like, that's not important right now. They were like, "we'll focus on that later, it's not important right now." So what was happening was I was getting kind of frustrated because I didn't know how to do my role because what would happen is we would all be talking about things and I would say this, if I knew that, I would suggest this, if I knew that. So when I left after one of the sessions, I said I really need to assert myself and say okay, this isn't working and this is why, but I was leery because I didn't know if there was a reason why I wasn't given [that information]. Why the tutors were [saying], "it's not important right now," and one of the

tutors was a social worker. So I thought maybe I don't need to know this information because later on he's going to be in a hospital setting and then that is when my role is going to come in because he's in a hospital and I [could say] that I know his family and suddenly my role would [be to] look after his funeral arrangements or something. I tried to figure out that, but it still kept going back to he's bi-polar and this and that and other people could [contribute to the discussion on whether] he should be in a support group, [etc]. But we live in the lower mainland so there are [many] options, so I was [thinking] that it could be any support group.

Finally, she stated how she resolved the issue, but points out that the task of creating a patient profile should have been adopted as a group activity:

Somewhat, but I feel that it is still under recognized...I feel that there's humour in the discussion now when it should be serious, but it is included now for sure. And even the [nurse on our team] said to me that she didn't know what social workers did until she went in and worked with a social worker yesterday and oh my gosh, [she learned] that they need to know this, this, and this. And I [thought], I know! So it has changed. I talked to three of the members and they wanted me to create the profile for the character, but that should have been done as a group and I emphasized a couple of times that it should be done as a group, but I ended up doing just a general profile and it does work a lot better now. I'm a social worker and not in medicine or dietetics or anything like that, it's totally about the emotional well-being of somebody. That's what is really important.

The interview with the social work student supported the initial finding from analysis of the observation data that the biomedically oriented case and the insufficient patient case history was the source of the breakdown, but also the driving force behind the creation of a new artefact (the patient's social history). The interview with the nutrition student from TEAM B (Table 4.6) suggests that a similar problem affected her ability to participate in the same way.

Table 4.7 A transcript excerpt of the interview with the nutrition student from TEAM B

Interviewer	Do you feel that you play a big enough role in the treatment of your patient? Put another way, do you feel that your role is well utilized at the right times?
Nutrition student	It's kind of hard to answer that question I think we [have] a really good team; the only thing that was kind of out of our own control was the way that the case was set up. We were just discussing this, that it was very medically and pharmaceutically based and we were waiting for them to talk about the nutritional status or even the social work aspect, and at no point did they even touch on it. It was always medical or always with the drugs and that sort of thing. So it's hard to answer that question in this context. But if he had been given the opportunity to talk about the social work more or the nutrition more, then we would for sure be represented more appropriately.
Interviewer	What tools could they give you that might help you with your role or how could they have set things up differently?
Nutrition student	We have been discussing this one as well. Again, it was very medically based so the sentiment in our group was that they did not put enough emphasis on nutrition and social work. I mean I think that with social work, we got a lot from the lectures and that sort of thing, but nutrition was definitely lacking. We only had one lecture on it and it was an hour and a half or an hour and forty minutes a few days ago. Up until that lecture, [nutrition] wasn't even mentioned. We didn't talk about it until the lecture and after the lecture, the same thing; we haven't really talked about it. It's kind of funny because it seems that nutrition is so important to people with HIV and AIDS, yet we don't think to emphasize it in the course. So, I thought that was kind of funny. It's good to place the emphasis on the medical side, but I take the holistic perspective. I mean, you can take your drugs and meds, but if you are not eating the right things with those drugs, it's not going to be effective, so I think there needs to be more emphasis.

Moments later, I asked her what tools were missing from the PBL activity. Again, she pointed out there was insufficient information to inform practice from her professional point of view.

As I said, we did not have any nutritional information whatsoever; it was always his medical condition.

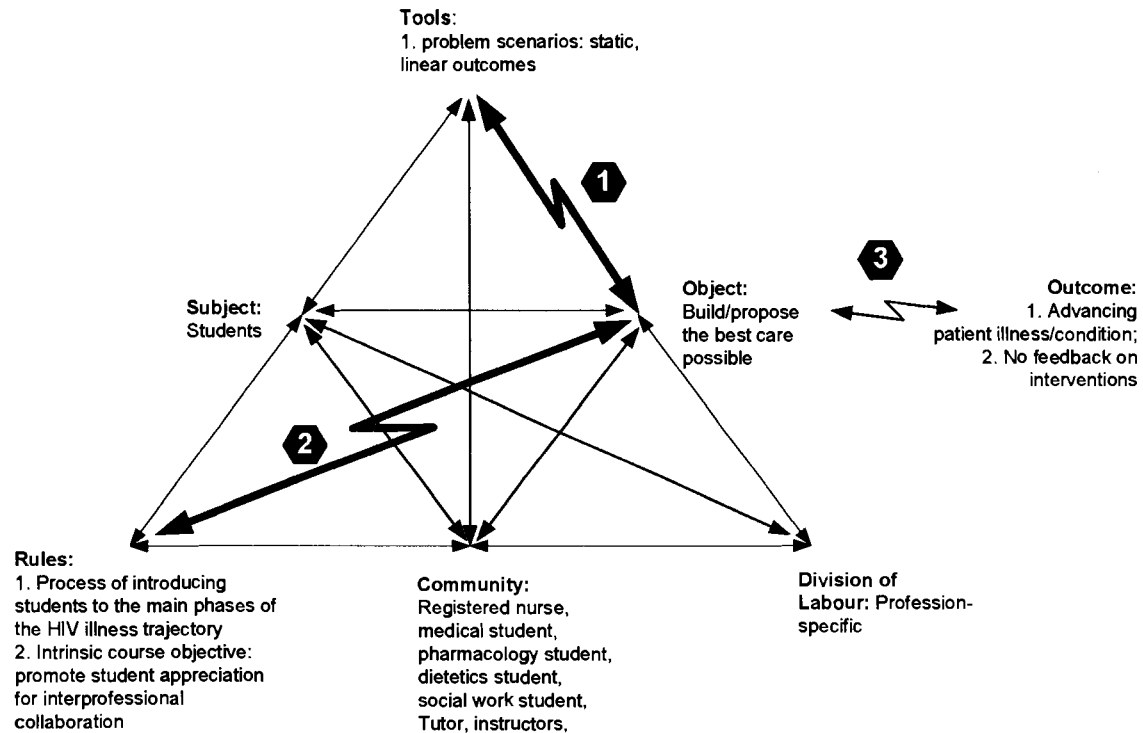
Members of TEAM B were also affected by the insufficient case information. In an interview with the pharmacy student from that team, she pointed out the following.

There were times during the PBL process where we all felt very frustrated because there wasn't enough information given to us and at that point in time it wasn't working for us to not have been given that information. But for presentation purposes, I felt that it was nice being able to make the patient up. It was just like when we were discussing things it would be all 'what ifs?' Like 'what if he's a drug user' or 'what if he's homeless' and in that sense we couldn't form conclusions during the PBL process...

The strength of an interprofessional team comes from its diversity. The first four excerpts suggest, however, that the biomedically oriented problem scenarios and the limited case history prevented the team from realizing this strength. The social work student from TEAM A was one participant who was hindered by this problem. Interviews with two members of TEAM B revealed that others were also affected. As a result, some team members were unable to participate fully in the collaborative process as members of an interprofessional team because the case instruments provided were inadequate for informing practice.

4.3 Tensions in Activity II

Figure 4.3 Tensions between the goal (optimal care) and the tools and rules mediating the activity



The observation and interview data suggests that some team members were dissatisfied with not being able to affect the condition of their patient. In the PBL meetings, students were expected to work together to propose holistic care interventions to address the issues presented by each problem scenario (object). However, regardless of the quality of the proposed care interventions, the patient’s health condition remained in steady decline (e.g. Table 4.7, line 112). Because of this, teams had no real way to evaluate their interventions or to gauge either individual or group effectiveness. In this way, the objective of helping students to “build, maintain, and evaluate the collaborative process as members of an interprofessional student team” did not appear to be sufficiently supported.

This discoordination between team interventions and patient outcomes (Figure 4.3, number 3) was traced back to the process by which problems were presented (i.e., rules) (Figure 4.3, number 2) and the case tools (Figure 4.3, number 1). Because PBL was used to introduce each of the main phases of the HIV/AIDS illness trajectory over the course of five PBL meetings,

there was little time to allow for the showing of collaborative care outcomes. For this reason, the PBL case was designed in a strictly linear fashion to ensure that each phase of the illness trajectory was presented regardless of the quality of care interventions proposed. Put another way, experimentation of different care interventions was not supported; the linear case was restricted to a single outcome. Because of this, interprofessional learning opportunities were quite limited. This inconsistency between the case instruments and the goal of providing the best care possible may have been responsible for creating some student dissatisfaction and perhaps even cynicism. Two examples are the remarks made by the nurse and the social work students in lines 120 and 121 of the following excerpt (Table 4.7).

Table 4.8 A transcript excerpt displaying students' comments about the static and linear case scenarios

Line	Participant	Action
112	Nurse	Presents "Day 4- the unstable phase" "Jason refuses the team's recommendation of ART. He is not seen for 6 months at which time he presents to the ER, short of breath, complaining of a dry cough and fatigue. He is "sating in the 70's." What Opportunistic Infections are you concerned about?"
113	Nurse	Expresses concern over "PCP" pneumonia
114	Tutor	Asks the rest of the team to list their profession specific concerns
115	Medicine	Identifies "oxygen" as a concern
116	Medicine	Identifies "MAC" and "TB" as concerns
117	Medicine	Identifies "bacterial pneumonia" as a concern
118	Social Work	"What is MAC?"
119	Medicine	"MAC is like TB..."
120	Nurse	"It's such a jump from [chapter] to [chapter]... Things have changed so quickly since the last time...It doesn't seem like what we did had any effect"
121	Social Work	"What we say doesn't make a difference...He just keeps going downhill!"

In an interview with the nurse from TEAM A, she indicated how on some occasions, the patient profiles that students had to create in order to inform practice were in conflict with what was presented in subsequent problem scenarios.

But at the same time, we took it upon ourselves to piece together this patient. The next time though what we fictitiously constructed before conflicted with what we were dealing with the next week. Like obviously, we don't know what we would be looking at.

This complaint suggests that there was no way for students to coordinate the construction of patient profiles with future problem scenarios. It also suggests that students may have been trying to construct their own patient stories based on the plot elements presented. However, because of the conflicts between students' stories and the story predetermined by instructors, some students were left dissatisfied with the degree of control they were given in the learning activity.

Furthermore, the static and linear nature of the narrative-based learning experience combined with the absence of tools for feedback prevented some students from creating meaning out of their experience. For example, in an interview with the medical student from TEAM B, he indicated how the lack of feedback prevented learning about the expectation or standards for acceptable or preferred practice.

Yeah, that was one of our main problems with the case. They intentionally left it vague, but it made it more difficult for us to learn because there were no specific objectives about what we were supposed to take away from the patient. We had no feedback on our interventions that we would initiate on the patient. The tutor had no tutor manual for when we were going astray or when we were doing something right or wrong or something that is preferred or not, so I think those three things made it difficult.

The nurse from TEAM B was asked about the idea of using a simulation to support the current PBL activity. She responded positively to the suggestion.

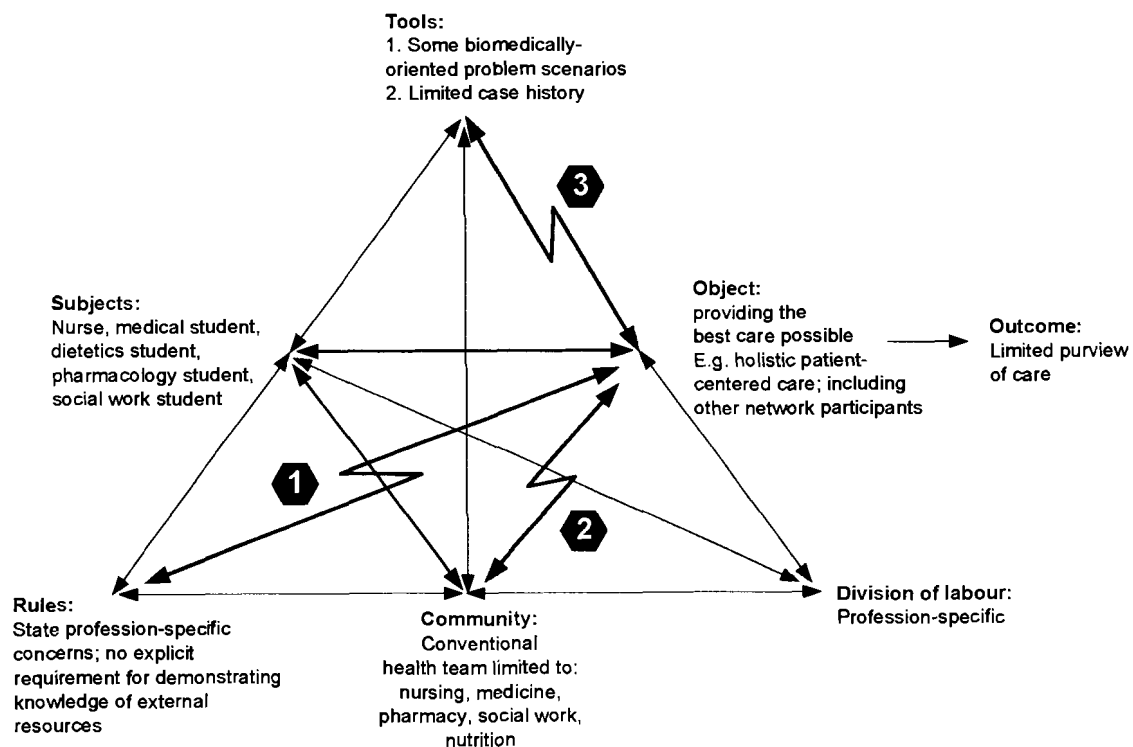
Sure, most definitely. It would be something more tangible than what is put on a piece of paper. [Right now] it's very evasive. We're now trying to fill in the blanks and collectively try to figure out who the [patient] is. To have a patient right in front of us, to tell us who he is, assuming that he would know ahead of time the direction the case was going...he could fill us in on a need to know basis.

The previous transcripts suggest that the way the design rules and instruments were enacted in this PBL implementation obstructed the achievement of one of the goals of the

learning activity, which was to build student appreciation for collaborative practice. The design goal of exposing students to all the main stages of illness was enacted in such a way that prevented students from seeing the qualitative benefits of interprofessionally-based practice over atomistic or multiprofessional approaches. In addition, the static instruments, which provided no feedback on interventions, limited opportunities for reflection on individual and group practice. Collectively, these limitations of the current design seemed to leave some students dissatisfied with the quality of interactions afforded by the learning activity and possibly even cynical about the benefits of interprofessional collaboration.

4.4 Tensions in Activity III

Figure 4.4 Tensions between the goal (optimal care) and the limited community, rules, and mediating tools



During the course, a large number of different professions were invited to make presentations to students. This list included street nurses, mental health clinicians, addiction counsellors, representatives from non-governmental agencies (NGOs), a bioethicist, physicians, epidemiologists, social workers, nurses, a psychologist, a psychiatrist, pharmacists, a police

officer, health administrators, and community volunteers. In addition, the clinical placement component of the course, which paired students from one profession with licensed professionals from another, gave participants the opportunity to learn about the roles and responsibilities of members of interprofessional teams through in-practice encounters. The purpose of these presentations and clinical placements was to reveal the broader network of resources, such as the professionals and agencies involved in HIV/AIDS-related research, and care and to promote use of those resources in future practice. In addition, as part of the course objectives, students were expected to “demonstrate knowledge of community resources” specific to the needs of their patient. However, the observation data suggests that in formulating their group interventions, TEAM A restricted their practice network almost exclusively to five professions: medicine, pharmacy, nursing, social work, and nutrition. This was also apparent in their final project presentation, where they described care strategies that involved only these five professions.

An examination of the data for reasons why this occurred suggested the presence of three structural tensions in the learning activity. The first is a *contradiction* between the rules, or in this case, no explicit requirement for teams to enlist or demonstrate knowledge of other caregivers in the care of their patient and the object of activity, which was to propose the best care possible (Figure 4.4, number 1). The second is a tension between the community of practice, which comprised only five professions, and the object of activity (Figure 4.4, number 2). In one of the meetings, a general discussion about possible patient support groups did occur, but compatible groups were not identified because there was no means for testing suitability. Third, in some problem scenarios, the biomedically oriented problem scenarios and limited case history appeared to limit opportunities for learning about potential helpers. Because of this, care interventions may have been sub-optimal because the strengths and limitations of some professions were not well understood by team members (Figure 4.4, number 3).

These tensions were illuminated by examining the composition of teams in light of the aims and objectives of the course. This examination revealed that many of the patient issues that were presented in the problem scenarios were either dealt with internally or not directly addressed. This was clearly contradictory course objectives and example of an undesirable form of professional practice. One course objective in particular suggested students should be able to “demonstrate knowledge of community resources specific to the needs of persons living with HIV.” Yet, although there were several good reasons for members of TEAM A to enlist the help of others in the care of their patient, care interventions appeared to be circumscribed to the five member teams assembled by course instructors.

For example, the following excerpts show three separate occasions when, during the PBL meetings, the topic of the patient's mental health became the issue at hand (e.g., line 08, line 88-90, line 99). However, in none of these instances does the team actually demonstrate knowledge about professional and community resources that are specific to the mental health needs of their patient. Rather, team members exchange scientific knowledge about mental health instead of exploring how to best manage their patient's mental issues to achieve long-term patient treatment and health objectives.

Table 4.9 Transcript excerpts showing several occasions where mental health was the issue at hand

Line	Participant	Action
08	Pharmacy	"Drugs for bipolars depend on the situation, patient SSRI, mood stabilizers, anti-psychotics..."
88	Social Work	"We want to find out why he's not taking his ARVs...is it his depression?"
89	Tutor	"Why do bipolars not like about taking the meds?"
90	Social Work	"If he's in a manic state, he may be at high risk of spreading the disease..."
97	Tutor	Asks team about their other concerns
98	Social Work	States "mental health" as her concern
99	Social Work	"Should you do a test at this point to see if his mental health is impacting on his physical health?"
100	Nurse	"...Is he eating, does he have food?"
101	Tutor	Suggests that Jason may not share the same goals/concern(s) with the care team

The excerpt below (Table 4.9) shows the nurse and social work student considering the possibility that their patient contracted HIV because of his addiction problem. Despite having knowledge about the high risk for HIV transmission because of his substance abuse problem, they do not stop to consider preventative measures, such as the possibility of enlisting professional help for this problem. Instead, the discussion that ensued focused on nutritional concerns and then to the case questions in the subsequent chapter.

Table 4.10 A transcript excerpt showing discussion about patient’s substance abuse

Line	Participant	Action
16	Nurse	"Are they at more high risk behaviour when on drug or alcohol use?"
17	Social Work	"Addicts are at high risk for [HIV] infection..."

The following excerpts (Table 4.10) suggest examples of opportune occasions in which other roles could have been more deeply examined and perhaps enlisted to support patient care, but were not. This may have been due partly to the time constraints of the PBL meeting, but the transcript also suggests that the tutor may have unwittingly hindered, or even prevented, this opportunity.

In the first instance (line 147 and 148), the nurse asks the tutor whether her team should investigate “power of attorney”. The tutor responds positively and suggests to the team that they should examine the Health Care Consent Act. However, despite the tutor’s good intentions, in this context, this approach was not conducive to promoting learning about other professional roles. A complementary approach may help to achieve this might be to ask students to identify people in their organization who could be consulted to provide answers to legal questions. Approaching the question in this way could help to reveal existing sources of expertise in health organizations that students may have not known about and, in this way, could help to promote new opportunities for collaboration that could lead to improvements in the quality of patient care.

In the second instance, (line 185-188) the social work student and tutor discuss the issue of pastoral care. However, there is no attempt to enlist spiritual support at this stage of illness. Instead, the conversation focuses on the role of social work.

Table 4.11 A transcript excerpt displaying discussion related to legal and spiritual issues

Line	Participant	Action
147	Nurse	<i>"What about power of attorney...should we be looking at that here?"</i>
148	Tutor	Suggests learning objectives: Health Care Consent Act, power of attorney, substitute decision making
185	Tutor	<i>"When should you discuss pastoral care?"</i>
186	Social work	<i>"We should have done that beforehand...before Jason died."</i>
187	Tutor	<i>"Sometimes social work and pastoral care overlaps. What would you (as the social worker) help [the family] with?"</i>
188	Social work	Suggests helping family with "coping skills"

The above examples highlight opportunities for investigations into how caregivers and helpers outside the immediate team might be able to contribute to increasing capacity for patient care. However, because there were no explicit evaluation criteria requiring teams to enlist these other resources, there was no compelling reason for members of TEAM A to focus attention outside of the team or to discover and to incorporate other resources into their proposed care intervention.

This structural tension led to an inadequate approach to patient care. In their class presentation, which took place on the final day of the course, TEAM A described how they planned to meet some of their patient's medical, nutritional, pharmaceutical, nursing, and social needs, but they did not propose options for addressing other potentially confounding factors, such as their patient's existing mental health and substance abuse issues. In addition, there was an absence of discussion on how or whether to engage the patient in his own care. There also was no discussion on the role of family or friends in ongoing patient care. It was only in the last meeting, where the team was presented with a scenario that directly involved dealing with the patient's family over end-of-life issues, that they had discussions about the role of the family. Even then, the discussion at this stage was not on how to promote family involvement in patient care, but how to deal with family concerns and wishes at the end-stages of illness.

An interview with the medical student from TEAM B, which took place on the last day of class, also raised questions about how much students were really learning about professional roles. When asked for his view on how to promote a better understanding about the roles of different professions in caring for HIV patients, he suggested that the learning design might have actually limited opportunities for learning about different professional roles. He suggested a design alternative to resolve this issue, but, according to his response, learning about professional roles meant learning more about those roles that were represented within his team.

The suggestion that we gave was...if they want [us] to gain a better understanding of each discipline, instead of making it intentionally vague, make it intentionally specific, and discipline specific, so we thought it would be more beneficial if we have five days, [and on each day] you go into each discipline. The way the case was presented, it was presented in a medical fashion, and there [was] nothing about nutrition except for BMI. There was very little about social work except for marginalization and vulnerability. And nursing, we didn't have a nurse in our group so it was kind of difficult for us to see where nursing would play in it. So we thought that if we actually went deep into each one, we would have a deeper appreciation of each one of the disciplines instead of having this vague nebulous idea.

The data suggest the students were cognizant of the broad range of health and social concerns affecting their patient and of their own limitations as professionals. Yet, the members of TEAM A limited their practice network to their own professions, thereby failing to address the presented health needs of their patient. While there may be other possible contextual factors contributing to this tension and the others mentioned previously, the findings from this study suggest some initial hypotheses for design experimentation.

This study demonstrates the use of activity theory with modified grounded theory analysis techniques to illuminate design issues in one PBL implementation. Although these design issues are valuable for informing the design of HEALTHSIMNET, design work does not necessarily have to involve this level of scientific rigor. The experimental phase of learning technology design can justifiably test innovations that are informed by commonly held beliefs about what has been shown to work in related or even unrelated areas. Thus, this study presents only one of many possible approaches to generating initial designs. In the next section, some design alternatives that make use of the affordances of multimedia simulation are suggested to resolve the tensions illuminated in this study.

5.0 DESIGN ALTERNATIVES

A design for HEALTHSIMNET is only partly suggested by the findings from this study. The structural tensions that were illuminated suggest three possible areas for development. In this chapter, I suggest some simulation-based design alternatives to resolve these tensions. These design alternatives were conceived with current affordances and limitations of modern desktop computing technology in mind. In the first section, I suggest a simulation-mediated design alternative for each of the three sets of hypothesized tensions presented in the previous chapter. In the second section, a hypothetical example is presented to illustrate how these design alternatives could be applied in a PBL setting to support interprofessional learning.

5.1 A Design Alternative for Resolving TENSION I

The first hypothesized tension implicates the static and partial patient case history and the biomedically focused scenario as the elements that hindered group problem solving. The case history was intended to provide background about the patient, while the problem scenario provided current information about the patient health status. In certain cases, both these elements, as presented, appeared to be insufficient for informing all stakeholder concerns. Duffy & Savery (1994) suggest that far too often, when problems are presented, the only information that is provided is the key information relevant for the desired solution. In this case, the key information suggests a medically based solution. This was not the intent. Rather, the intent was to promote holistic approaches and to encourage full team involvement. Nevertheless, the findings suggest that two professions, social work, and nutrition were, at certain times, marginalized by the biomedical bias and the limited patient case history, but other professions may have been effected as well.

In health and social care work, accurate and complete patient information is essential for practice. The absence of such information makes diagnostic work and other types of decision making difficult, if not impossible. Yet, in real work context, information insufficiency is sometimes a recurrent fact of practice. Although in these contexts, there are usually ways of obtaining that information, such as accessing existing patient health records or by asking the

patient directly. In the PBL meetings, however, the obstacle to practice was not only that there was insufficient data, but also that, for some inquiries, there was no feasible way to obtain it.

Having students expand the patient's case history beforehand may have helped, but only in a limited way. For each scenario presented, it was critical for each profession to have access to information about the patient's current condition or status, whether social, psychological, medical, nutritional, or otherwise. If, like in the meetings observed, information about the patient's current condition or status is not provided, then the excluded professions must create it in order that they might participate in the activity. However, in the short amount of time allotted for each meeting, this additional activity did not seem feasible. Because of this, some professions were prevented from participating in the group discussions. In addition, interviews suggest that some students would have preferred to have the case history preconstructed. For one team, having a richly presented case history may have prevented the conflicts that arose between the fictitious case history and outcomes they imagined and the actual story that unfolded in the problem case study.

The hypothesized tension between the object (group problem solving) and the mediating artefacts (case history and the problem scenario) suggests the need to explore ways to improve case instruments to enable more equitable participation and to reduce conflicts between the artefacts that students produce and those prescribed by instructors.

5.1.1 The IPBLM: A rich information source for interprofessional teams

Duffy & Savery (1994) suggest two ways for presenting problem case. First, cases can be presented as a basic question. A basic question may provide few details, relying instead on other sources to complete the problem (e.g. Milter & Stinson, 1993). Alternatively, problems can be richly presented, consisting of the types of information could support a broad range of inquiries. In some implementations, problem information is presented as paper case histories. Not unlike the cases in the IHHS 402 course, case information is sometimes presented in narrative form. They can also be presented as a list of notes. Another approach taken is known as a PBLM. Distlehorst & Barrows (1982) describe a PBLM as a patient simulation tool that gives students the opportunity to:

- perceive initial clues
- to generate early hypotheses
- to inquire freely of the patient

(Distlehorst & Barrows, 1982, p. 486)

PBLMs were first introduced to help medical students develop clinical reasoning skills. They were developed because the printed case histories that were previously provided could not support critical aspects of the clinical reasoning process (p. 486). In particular, printed case histories did not allow free inquiry, which is the ability to obtain requisite patient information when needed to inform clinical decision-making.

The original PBLM consisted of two books. The first was the *Master Action List*, which is an alphabetically-ordered list of standard patient history questions, physical examination procedures, laboratory tests, and diagnostic procedures that could be performed on any patient. The second book was the *Patient Encounter*. This book contained answers to the all the questions contained in the Master Action List as well as the results of diagnostic tests and examinations (p. 487). Together these books allowed students to make any number of inquiries in order to make an accurate diagnosis.

A PBLM may be one way to resolve the various informational needs of interprofessional teams. However, a PBLM for interprofessional learning, which will hereafter be referred to as an interprofessional problem-based learning module (IPBLM), should have these additional characteristics. First, the Master Action List should contain standard patient or client inquiries for each profession. Unlike the original PBLMs, which provided a comprehensive list of questions

that reflected a single disciplinary perspective, an IPBLM should be capable of supporting multiple disciplinary concerns. That is, the index of standard questions should be developed which reflect the health or social care concerns of the professions represented by participants in the PBL activity. In addition, it should contain both historical and current information about the patient. Historical information pertains to the patient's background, such as his social or medical history, and the current information indicates his present status or condition.

Second, conventional PBLMs typically allow any participant to make an inquiry as long as it exists on the master action list. This level of access was allowed because the emphasis was only helping students to develop their clinical reasoning ability. However, in real interprofessional work settings, there are organizational rules governing how information can be obtained and shared between caregivers and helpers. In other words, some information is privileged. For instance, there are privacy regulations governing how patient health information can, and should, be collected and guidelines for sharing it with others. Incorporating these rules within the simulation would increase the authenticity of the experience and possibly create new opportunities for learning. For instance, notifying users that there will be a hefty fine imposed on those who wrongfully divulge a patient's HIV status in the simulation may compel participants to investigate local confidentiality rules with regard to HIV and public health. In this way, the simulation could help to build awareness about the institutional factors that impinge on collaborative practice, and thereby help to prepare learners for the challenges of real work.

Conventional PBLMs are simple paper-based databases. With these PBLMs, users could make inquiries simply by search for questions and answers in an index. To provide a more authentic experience, a multimedia simulation-based IPBLM should enable more realistic information gathering practices. In other words, instead of simply choosing from a list of standard questions, answers to inquires should only be obtainable through realistic methods, such as through patient consultation, comprehensive testing, by using informational artefacts, or through interactions with other resources. For instance, to find out about a patient's employment status, the user must request a meeting with their patient and choose the right questions from a list of possible choices. Similarly, medical tests can be performed on patients by selecting them from a list of possible actions, which are specific to the particular profession making the request. For example, in the simulation, only nurses and physicians can request a HIV test. Simulation artefacts, like laboratory test reports, can also be sources of patient information. In addition to supporting the development of clinical reasoning abilities, applying this design would allow and encourage users to engage in authentic information gathering practices, and thereby allow for

meaningful learning experiences. In the last section of this chapter, I will illustrate how an IPBLM applied to HEALTHSIMNET can help to inform individual and group decisions in PBL.

5.1.2 Summary

In at least one PBL meeting, it appeared that student participation was constrained due to both a biomedically oriented problem scenario and to insufficient patient case information. This problem suggests the need for not only a rich case instrument, but also an information source that can support the various practical needs of an interprofessional team. A PBLM is a starting model for such a tool. However, unlike conventional PBLMs, which emphasized medical reasoning, an IPBLM for IPE should also be capable of supporting a much broader view of patient care. It should also be capable of supporting authentic information gathering and sharing practices. To achieve this, information access should be regulated by the same rules that govern real practice. Which particular rules to incorporate is beyond the scope of this thesis, but it is a question that will be investigated in future research. In addition, patient information should be accessed through realistic methods, such as by consulting patients, requesting tests, or interacting with artefacts and other resources. A multimedia simulation can support all these ideas. An IPBLM could be implemented as a relational database of questions and answers. Rules should also be applied to govern information access, as well as the consequences for breaking these rules. Finally, access to information for practice could be offered through simulated patients, informational artefacts, and other interactive resources within the simulation environment. This design not only enables full participation from all members of an interprofessional team, but also offers the possibility of authentic practices, and thereby more meaningful learning.

5.2 Design Alternatives for Resolving TENSION II

The data suggests that some students wanted to go beyond the considerations for practice. They wanted to construct and apply care interventions and to receive feedback on whether their strategies were adequate for the problem scenario. This finding was consistent with Duffy & Savery's (1994) suggestion that student want to know the outcomes of problems. However, this was not possible because the cases were non-interactive and the tutor manual, which contained hints and suggestions for practice, was not effectively used.

In addition, the activity was designed to expose students to problems at each phase of the HIV illness trajectory over five short PBL meetings. In most cases, the scenarios focused on the advancing illness and provided no clues about whether previous interventions were of any

success. In fact, the majority of interventions were treated as having no effect at all. Contrary to the goals of interprofessional education, this experience gave students few good reasons to appreciate the benefits of real collaborative practice. To this end, it may benefit interprofessional learning to allow students to affect case outcomes and to allow them to see the consequences of their decisions.

5.2.1 Using design in interprofessional PBL

Nelson (2003) posits that design is a problem-solving process. Whether we are designing technical artefacts or plans for addressing patient issues, design is an activity that is inherently linked to problem solving. Design itself is a cyclical process that entails defining the problem, proposing solution prototypes, implementation, and evaluation and reflection. Nelson suggests a slightly different conception of this process that consists of four stages: In the *naming* stage, the main problem issues are identified. Next comes *framing*, where the limits of the problem are defined. In *moving*, an experimental design action is taken. Then in *reflecting*, the design is evaluated and criticized (Nelson, 2003, p. 40).

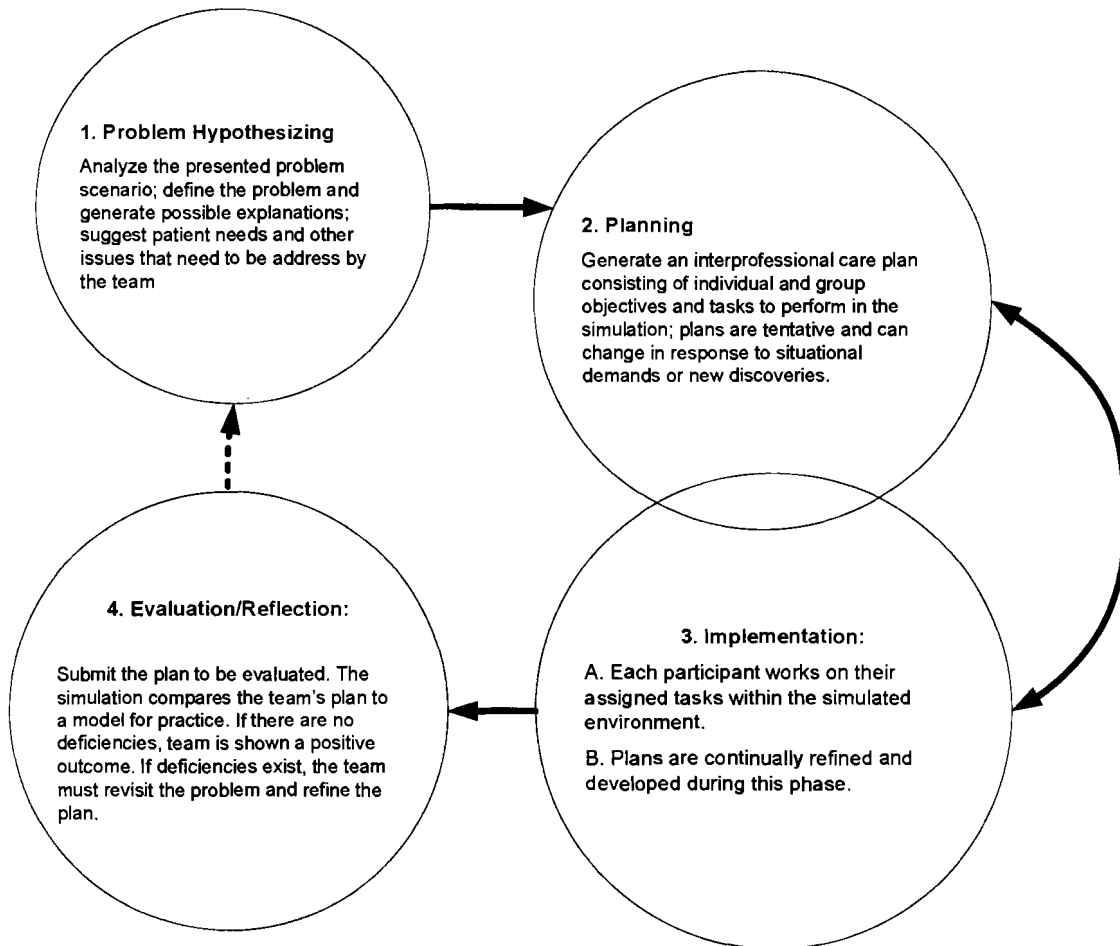
Some PBL implementations stop short of a full design cycle. In implementations where simulation is not used, learning activity typically moves through the problem definition and solution proposal stages, but does not fully move through the implementation and evaluation phases. In situations where there is no requirement or support for testing solution prototypes, solutions are often conceived in the abstract, consisting of general considerations for practice rather than concrete decisions and commitments for action. Because of this, learners are not able to engage in and benefit from authentic cognitive experiences, which is critical for learning that is meaningful (Duffy & Jonassen, 1992).

Enabling design is one way to resolve this limitation. Duffy & Jonassen (1992) suggest that allowing learners to engage in the planning process may be one way to provide opportunities for meaningful learning. Supporting this process may be beneficial for interprofessional learning because it forces participants to raise and confront questions about roles, tasks, dependencies, and coordination. An interactive multimedia simulation can be especially useful here because they can provide a realistic environment within which teams may transform their ideas into plans that can be tested for feedback.

However, because computer simulations are computational, plans must be formalized into some propositional form before they can be evaluated. One approach may be to allow teams to express their ideas for addressing patient issues through their interactions in the simulation

environment. In other words, allow team members to interact with simulated caregivers and artefacts to resolve patient issues, and enable the simulation to encode these interactions as discreet actions that can be evaluated against a predefined model for practice. Based on this idea, I propose a simulation-mediated learning activity that proceeds as follows (Figure 5.1).

Figure 5.1 Phases of simulation-supported PBL activity



1. Problem hypothesizing. The simulation presents the team with a patient problem scenario. For example, an HIV patient's health is in rapid decline despite being on antiretroviral drugs. Members engage in a PBL process that entails: a) clarifying terms and concepts, b) resolving knowledge deficiencies, c) defining the problem based on the case information, d) and generating possible explanations for the problem.

2. Planning. The team performs a needs assessment of both the patient and the team, prioritizes issues and concerns, and propose a coordinated plan to resolve each identified issue. A

plan represents a proposed interprofessional care intervention. Plans contain objectives and tasks that must be translated by users into actions that can be implemented in the simulation. Plans are provisional, they represent what is currently known, and can thus change in response to situational demands or new discoveries. In figure 5.1, the overlap between planning and implementation is there to suggest that planning does not only happen in one discreet phase, but also throughout implementation.

3. Implementation. The purpose of the implementation phase is to allow teams to develop their plans. More importantly, it allows them to discover the implications of interactions of multiple variables on these plans. In this phase, team members enter the multi-participant simulation to perform their assigned tasks. They do so while ‘playing’ their own professional role within an interactive virtual city. For example, a priority for supporting treatment adherence might be to ensure that the patient has adequate housing and a good diet. Such a responsibility might be assigned to the social work student. If so, a task is to investigate whether the patient has adequate housing and access to food. This information can be obtained by interviewing the simulated patient. If the patient is homeless, then two additional tasks might be to arrange for social housing and to apply for social assistance. Within the simulated city, the social work student, playing the role of a social worker, must try to locate computer controlled agents who have the authority to provide social housing and must attempt to arrange adequate housing for her client. Like in real life, she may have to fill out application forms and may do so within the simulation. If she follows the steps for obtaining housing as specified by the simulation, her client is provided with social housing and the social work student moves on to pursue another task. If her initial attempts fail for any reason, the player may re-perform the task as often as necessary to achieve the objective without it harming her status or the potential outcome. In the meantime, other members of the team are also using the simulation to create and complete tasks directed achieving the team goal.

Table 5.1 Example tasks involved in supporting patient treatment

Profession	Example task(s)
Social work	Help client with social housing application; help client apply for social assistance
Nutrition	Formulate a nutrition plan to support antiretroviral therapy
Medicine	Perform medical examination of patient to prescribe right medications
Nurse	Assist physician with examination; help to identify social needs
Pharmacy	Research factors that might affect ADME (absorption, distribution, metabolism, excretion) of drugs? Research drug interactions and inform patient's physician.

4. Evaluation. Tasks are implemented in the simulation as actions. Actions refer to user interactions with other characters or resources in the simulation. Actions are constrained by the technical design of the environment and are governed by some of the same rules of real practice. All actions performed are logged by the simulation. For example, conversations with other characters in the simulations are logged. Also recorded are recommendations that are inputted into the simulation, such as drug combinations, nutritional plans, and social support resources. Together, team recommendations and the log of actions are stored as one complete care intervention. Teams can work on their interventions until they are satisfied that all their objectives are met and at which point, they can 'submit it' to the simulation for evaluation. The evaluation involves comparing each element of the logged intervention against those from a model of practice pre-specified by course authors. This model is a checklist that specifies what patient issues must be addressed for given problem scenario. How issues can be addressed is specified by the simulation. For example, enlisting social support can only be performed with the permission of the simulated patient. If all elements from a team's proposed intervention match the evaluation model, then the intervention is accepted as an appropriate interprofessional intervention for the problem. Feedback is provided in the form of video clip that describes how the intervention led to a positive outcome and the team is advanced to the next problem scenario. If components are missing (e.g. no housing for patient or no compatible nutrition plan) feedback is given indicating why the intervention failed (i.e., shows what patient needs that were not met) and the team must revisit the problem and develop their plan. Teams may also challenge the existing model and suggest ways to improve it. This is an additional and important learning opportunity that would likely involve negotiations between teams and instructors about limitations or deficiencies in the prescribed model. In this way, the model used for evaluation is itself a learning instrument that

can be deliberately designed to incorporate flaws that might provoke student questioning and discourse about what it means to provide patient care.

5.2.2 Summary

Enabling interprofessional teams to create, implement, and evaluate planned interventions could benefit interprofessional learning because it forces members to explore what actors (people, agencies, resources) are needed to resolve specific problem scenarios, what activities need to take place, the processes involved, and the interdependencies between roles. Enabling students to explore these questions is important for both assisting students to develop specific collaborative competencies and for enabling students to discover what it means to collaborate with other professions in the context of real problems.

5.3 Design Alternatives for Addressing TENSION III

The third tension refers to a structural deficiency in PBL activity that led to development of inadequate care interventions. More specifically, teams proposed care interventions that consisted of only five professions despite the fact that patient problems extended beyond their capacity to provide effective care. For example, although there were issues raised about mental health and substance abuse during PBL meetings, the study participants did not or were not able to enlist mental health and addiction services into their patient's care network. In addition, despite course objectives, study participants did not clearly demonstrate their knowledge of community resources specific to the needs of their patient. Community resources appeared to be brief discussion points rather than the object of full investigations on when other roles should or could be incorporated, what specific value they could add to the team, what potential conflicts or challenges might emerge, and how these resources might actually affect patient health and wellbeing.

5.3.1 Team expansion and knotworking

Over the course of the five PBL meetings, team composition remained the same despite the manifold problems that emerged that were clearly outside the bounds of team function and expertise. Successful healthcare teams working in chronic illness are rarely this static. Engeström, Engeström, & Vahaaho (1999) suggest that contemporary work teams are commonly dynamic entities, having compositions and power structures that shift from moment to moment in response to emergent situational demands. Put another way, teams are not compositionally or

hierarchically stable, but are formed and reformed in response to evolving and emergent conditions and objectives. This is a phenomenon that they call “knotworking”, which is characterized by “a pulsating movement of tying and retying together otherwise separate threads of activity” (Engeström, Engeström, & Vahaaho, 1999, p. 346). For example, in healthcare team, at one moment, it might consist of a physician, a nurse, and a social worker with control in the hands of the physician. In another moment, a mental health clinician is invited onto the team to discuss the patient’s mental state and the power might shift to her. In addition, Nardi, Whittaker, & Schwarz (2002) posit that workgroups are increasingly composed of members found through personal networks rather than being products of organizational planning. However, the PBL design did not allow for such organizational dynamics to occur. As mentioned previously, PBL teams were static and restricted to the same five members throughout the course. In addition, only five professions were represented in each team, and there did not appear to be any explicit requirement for teams to explore the potential benefits of enlisting other caregivers or helpers in the care of their patients. A potential resolution then, at least in part, may be to change the minimum requirements for acceptable care interventions. That is, to require teams to propose network-based solutions to meet the necessary conditions for successful patient health outcomes. Adding this requirement may help to encourage teams to explore the boundaries of their collective expertise, to investigate other roles, and to experiment with team composition and dynamics.

These possibilities for learning could be enabled in the simulation by incorporating interactive intelligent agents that represent HIV/AIDS a variety of different caregivers and helpers. During PBL, these agents serve three functions. First, they provide users with detailed information about the professions or roles they represent. Second, they provide users with role-privileged information. For example, a mental health clinician can provide the user with information about the patient’s mental condition or the patient’s friend may offer up information about the patient’s lifestyle. Third, they may be enlisted to support critical tasks. For example, a simulated hospital ethicist could be enlisted to provide general consultation on ethical dilemmas or a simulated treatment counsellor could be identified to provide ongoing treatment support for a patient.

Finding agents to support patient care will be a key team objective because the range of abilities for each role character played by participants will be limited. Moreover, care interventions will be partly judged by what roles have been incorporated into the proposed plan. For example, if a patient has a mental health condition and the goal is to achieve patient

adherence to HIV medication, then it might be reasonable to expect a mental health clinician to be part of a health team's care strategy. If such a role is not included, then the plan may be judged inadequate for the problem scenario.

5.3.2 Summary

In summary, two possibilities are suggested to resolve the third tension. The first is an additional rule requiring students to identify professional and non-professional helpers to address patient issues that are beyond the team's function and abilities. Such a requirement may force teams to examine their own professional boundaries and the role of other professions in patient care. Second, incorporating a simulation into the activity could allow students to enlist other roles in patient care, thereby enabling them to explore how these other roles might affect the quality of patient care. A multimedia simulation could provide interactive intelligent agents for enabling learners to explore the potential benefits of other primary and auxiliary roles. This would also allow instructors to evaluate the quality of care interventions designed and demonstrated by teams. However, it should not be used as a prescriptive instrument, but rather as a means to mediate innovative thinking about possibilities for collaborative care.

5.4 Incorporating Design Alternatives into the Conceptual Design: An Example Illustration of Interprofessional Learning with HEALTHSIMNET

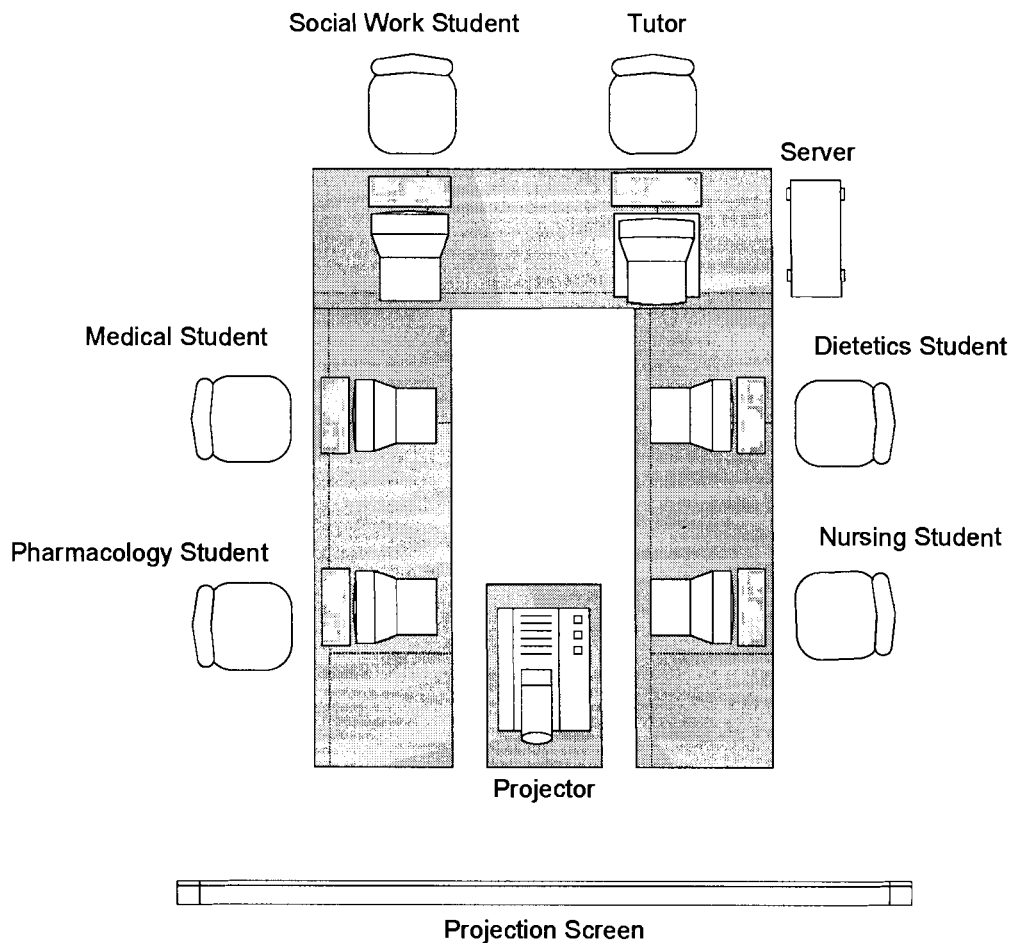
5.4.1 Overview

HEALTHSIMNET is envisioned as an interactive desktop multimedia simulation for interprofessional collaborative learning about HIV/AIDS care. It is intended for use in a multiprofessional problem-centred learning environment and will support interprofessional learning activity in two ways: First, it is a way to deliver a case study to a multiprofessional group of learners. It will be a source for case history information and it will sequentially present pre-authored problem scenarios from each phase of the HIV illness trajectory. Second, it will allow teams to test problem hypotheses by creating plans for patient care that they can implement and evaluate in an open-ended and realistic virtual environment.

The participants. The simulation-mediated learning activity can involve up to five participants who together constitute a partial health and social care team. Participants can be preservice or inservice health professionals. In the simulation, team members enter an interactive environment that resembles a city. There are buildings to explore, useable artefacts, and computer

controlled characters with which participants can interact. There are also institutional rules that define legitimate actions and processes. Each member adopt can one of five different functional roles: nursing, medicine, pharmacy, social work, or nutrition. Members are free to choose a role character that represents their own professional role or they can choose a different role, however, roles cannot be duplicated. When a member adopts a role character, they are given a range of abilities and authority to perform actions within the simulation environment. Abilities are profession specific. For example, only nurses and physicians can request an HIV test and only physicians can prescribe medication. Ideally, there should be five participants, but in situations where there are not, vacant roles can be appropriated by other team members. Tutors are responsible for facilitating the learning activity and can enter the simulation to monitor in-simulation interactions between participants and other agents and artefacts.

Figure 5.2 Example layout of the simulation-mediated PBL environment



The simulation mediated activity. The object of team activity is to propose a care intervention to address an assigned problem scenario for each phase in the HIV illness trajectory. For each problem, scenario there is a checklist of minimal patient needs and issues that must be addressed by the team order to advance to the next scenario. This checklist is not disclosed to the PBL team. Teams are responsible for determining for themselves what the objectives should be and how to achieve them in the simulation. These ideas are concretized into individual and group tasks. Once tasks have been decided, prioritized, and assigned, they are performed using the multimedia simulation that is installed on a networked computer. The simulation models a small city with a number of governmental and non-governmental agencies and imposes a realistic set of rules and constraints on participant interactions and professional practice. In this environment, participants can make use of material, informational, and human resources to generate and accomplish tasks that are directed at addressing patient needs and issues. Material resources are digital artefacts in the environment such as housing application forms and paper prescriptions for medication. Informational resources are both people in the simulation and objects such as medical reports. A PBLM model, consisting of a list of patient history questions and answers controls inquiries for information. As discussed earlier, most inquiries are restricted to particular professions and they can also be accessed through a consultation with a simulated patient.

What tasks are performed and with whom they are performed is logged by the simulation as a list of actions and resource utilizations. Team members also make recommendations such as specific drug combinations, nutritional plans, and social support resources. A completed log is saved as part of a complete intervention. When teams are satisfied with their intervention, which consists of a log of actions and resource utilizations and a list of team recommendations, they may submit it to the simulation's evaluation module for assessment and feedback.

Interventions are compared against a predefined model of practice. This model is a checklist of patients needs and issues that need to be addressed and a set of rules defining how they can be met. If a team's plan meets the minimum requirements for addressing the problem scenario, they are given a video clip in the simulation showing a positive patient outcome before they are advanced to the next problem scenario. If the simulation identifies deficiencies in the proposed care plan, the team can revisit the problem to revise their plan or they may challenge the existing model. Instructors may modify evaluation models if a team is successful in their challenge. Following the completion of all five problem scenarios, the log of interactions recorded by the simulation can be saved and used for presentation or in a report.

5.4.2 Example illustration of using HEALTHSIMNET in PBL

PBL Participants:

1. Nancy, Nursing student
2. Mary, Medical student
3. Diane, Nutrition student
4. Phil, Pharmacy student
5. Sam, Social work student
6. Dr. King, Tutor and HIV Specialist

Illness Phase: The Stable Phase

Problem scenario:

Paul has been HIV positive for four years. Today, he has come in to the hospital for a check-up. His CD4 count = 300cells/mm³ and VL > 100,000copies/mL. His weight has dropped to 72kg. It is clear from the results that Paul is becoming unstable. As Paul's physician, you decide to suggest starting highly activity antiretroviral therapy (HAART) to maintain his health. However, you are concerned about his ability to adhere to a complex dosing schedule because of lifestyle, social, and psychological issues. What could you do to improve Paul's ability to adhere to HAART? Consider his case history and current treatment issues and propose a plan to deal with these issues.

Based on a problem scenario from IHHS 402 - HIV/AIDS Prevention & Care

After reading the problem scenario, the team identifies some concepts to investigate. They are unclear about what is involved in HAART and conduct research to find out. They learn the HAART usually consists of three antiretroviral drugs from two different classes. Drug combinations must be made after careful consideration of issues such as drug-drug interactions, potential side effects, current or previous medications, and the patient's ability to adhere to a demanding dosing schedule. They also learn that total adherence to HAART is necessary to prevent "viral rebounding", or the increase of viral load and possible biological drug resistance following low adherence to antiretroviral therapy (Sethi et al., 2003).

With these points in mind, the team sets out to explore possible factors that could prevent patient adherence. By examining the online and print literature, they discover issues such as depression, lifestyle, addiction, access to treatment information, nutrition, and ongoing social support. According to the specifications of the activity, learning does not stop there. The team

now must investigate these issues with respect to their patient, so they enter the simulation, adopt characters that represent their own professional roles, and arrange meetings with their simulated patient to find out which of these factors apply to their patient.

Sam enters the simulation as a social worker and requests a meeting with Paul. He interacts with Paul by selecting questions from a predefined list. Sam learns from this meeting that Paul has had a history of alcohol abuse and has had recurrent bouts of depressions because of his condition. Paul recently ended a long relationship with his partner and is currently feeling depressed. Sam also learns that Paul is concerned about maintaining his good looks and has heard from friends that HAART may harm his facial appearance.

Next, Diane enters the simulation and plays the role of a clinical dietician. Diane requests a meeting with Paul to assess his nutritional needs. She learns that Paul is a vegetarian and notices from his appearance and weight information that he is very thin. Selecting from a list of questions, she chooses to ask Paul about his diet. She learns that he often skips breakfast and has a very simple diet based mainly on prepared frozen foods. Paul also works three days a week in a garment company and has high energy requirements. Diane conducts a nutritional assessment and discovers that Paul's diet is barely meeting his energy or nutritional requirements.

Having gathered this information about Paul, the team convenes and shares their findings. They create a list of objectives and tasks for each member. They decide to increase Paul's knowledge about HAART by connecting him to a treatment counsellor. They also decide to use Nancy to educate Paul about treatment issues. Diane points out Paul's nutritional issues as suggest that a nutrition plan needs to be created to increase his lipid and energy intake to counter the potential side effects of antiretroviral therapy. Mary volunteers to work with Phil to formulate a drug therapy for Paul, and Sam is asked to look into addiction counselling and to help Paul expand his social support network.

After the first planning session, team member enter the simulation at the same time to perform their assigned tasks. Again, Sam assumes a social work role and explores the virtual city. Sam's first destination is an agency called the Person's with HIV/AIDS society. There, he finds a character named Ted. Sam interacts with Ted using a multiple choice dialog tool and learns that he is a treatment counsellor who is HIV positive. Sam then notes this finding and proposes to the team that they should include Ted as a team member to provide treatment counselling to Paul. Some members of the team are unclear about what treatment counsellors do and so they ask Dr. King, their tutor. Dr. King suggests the team turn to the web or visit an AIDS organization to find out for themselves. Sam has a better idea. He returns to the simulation to locate Ted and asks him

to describe his role. The team listens in and learns that Ted can provide ongoing information support to Paul about conventional, complementary, and alternative therapies. The team decides that it might be a good idea to recommend a treatment counsellor, so they enlist him as a part of their care strategy.

Following this discussion, the team members return to performing their own tasks. Mary and Phil use the information Sam gathered about Paul to tailor a drug combination for Paul. Nancy enters the simulation and requests a meeting with Paul to provide him with detailed information about HAART. Sam re-enters the simulation and locates Paul's brother. Sam tells Paul's brother about his condition in an attempt to expand Paul's support network. In the meantime, Diane is working on a nutrition plan, but is concerned about food-drug interactions, so she consults with Mary and Phil. Together they look up information in bioavailability and conclude that they need to increase Paul's lipid intake at each meal to maximize adsorption and the metabolizing of drugs and other nutrients. Diane completes her plan and returns to the simulation to input her meal recommendations. Likewise, Mary and Phil enter the simulation and input their HAART combination. The team decides that all tasks have been completed and objectives met, so they submit their work, which consists of a list of recommendations and their action log, to the simulation for an evaluation.

The team's proposed care intervention is evaluated and they are told that it was not only successful, but also harmful. A video clip indicates that the team worsened Paul's depressive state. Paul is shown crying and tells them that he had been hiding his condition from his family for four years, but they now know about his HIV status. This news has shocked and angered members of Paul's family, especially his father, who no longer speaks to him. The team reflects on their actions and realize the Sam disclosed Paul's HIV status to a family member without his permission. In doing so, not only did he harm Paul's relationship with his family, but also unwittingly violated patient confidentiality laws. Because of this, the team is instructed to redo the problem scenario. On the second try, all of Paul's needs are adequately met and the simulation informs the team that Paul can begin HAART and that the likelihood that he will adhere to the regimen is high.

6.0 CONCLUSION

6.1 Research Questions Revisited

The three questions that guided this study will now be reiterated here. The first research question asked: *How can activity theory be used to inform the design of a multimedia simulation for interprofessional education?* Activity theory offers a conceptual framework for describing the structure of a learning activity and for generating possible structural explanations for problems arising from a particular PBL implementation for interprofessional learning. In this pilot study, grounded theory techniques were applied within an activity theory framework to examine the activity system of learners in a PBL environment for IPE. This approach assisted in illuminating the structural sources of problems that emerged in one interprofessional learning activity. In this way, activity theory proved to be an ontological innovation (diSessa & Cobb, 2004) for informing future priorities and directions for simulation design.

With this combination of activity theory, grounded theory coding, and a design-based research approach to instructional technology design, this work has demonstrated an empirical method for informing the development of a multimedia simulation for interprofessional learning. Design work however, does not always have to involve this level of scientific rigor. Designs can, and often are in the design-based research methodology, justifiably generated from previous research (Cobb et al., 2003) or from widely held beliefs about what is likely to work in related or unrelated contexts. However, for learning contexts that are not well understood or for which there is little prior research to specify a design, activity theory may be of value for generating insights to inform design.

The second research question asked: *What are the tensions that characterize learning in an interprofessional learning environment?* The study examined a problem-based learning environment in an interprofessional course on HIV/AIDS prevention and care. The first set of tensions that were identified implicates deficiencies and biomedical bias in one problem scenario as the aspects of the design that prevented participation from one member of the learning team. Findings also suggest that these tensions were resolved by transforming the case history from a limited artefact to one that could inform other points of view. The second set of tensions

implicates the non-interactive case as one element of the design that hindered interprofessional learning. One student indicated that his team developed care interventions to address patient issues, but because there was no way to test their ideas, there was no way to create meaning out of their experience. The third set of tensions pertained to a deficiency between the goal of optimal care and the composition of the care team. Although students were encouraged to enlist other role participants in patient care, there were no explicit requirements for them to do so. Because of this, the focus on learning about roles was limited to the professions represented by team members. As a result, proposed approaches to challenging treatment situations were inadequate for the types of patient issues presented.

Finally, the third research question asked: *How can a multimedia simulation be designed and used to resolve these tensions?* The first set of tensions suggests the need for a rich case instrument that can satisfy the practical needs of all participating professions. Based on an IPBLM model, a simulation can address this need by acting as an information query and retrieval tool to provide requisite information to inform various approaches to patient practice. It can also be used to deliver problem scenarios and to facilitate useful interactions with a simulated patient. To resolve the second set of tensions, a simulation design was proposed to enable teams to interactively design and test collaborative care interventions within a realistic problem space. Finally, a simulation can help to promote practical learning about other care resources by a) requiring teams to address all the health and social needs of their patient and by b) providing teams with access to simulated caregivers and helpers whom they can enlist to expand their scope of knowledge and expertise for dealing with patient needs.

6.2 Limitations and Future Research

While the findings of this pilot study suggest a number of design implications for HEALTHSIMNET, they must be viewed within the limitations of the study. The observation phase of the study focused on only three of five PBL meetings. In addition, the observation data reflects only a small amount of group learning activity in the course. A significant amount of group work that occurred outside of the classroom was not recorded and several student artefacts that were used to support work were not collected as part of the analysis. Observing all five meetings and expanding data collection and analysis to student artefacts and to interactions outside the classroom may have led to a different set of findings.

Each of the six teams in the course was provided with different cases to manage and each case contained different amounts of case history data. Therefore, conducting multiple case studies

would have provided a broader, more complete, view of the design, and thus may have also enable additional or different findings to be made.

Triangulation of the observation data were limited to interviews, and although they were conducted with members from two teams, views from two important members of the case study (the medical student and pharmacy student from TEAM A) were not represented because of scheduling challenges. Interviewing the tutors may have also provided additional insights. Applying other data collection methods, such as surveys, would have increased the trustworthiness of findings. Adding quantitative analysis of participation rates and interactions between participants may have also provided different insights.

Because of these limitations, the findings suggested in this thesis are preliminary and should be verified in future case studies using the methodological enhancements suggested here.

In addition, the simulation design is only partly suggested by the findings. For instance, the findings only partly inform the technical and interaction design. Future research needs to investigate approaches to implementation of design alternatives. IPBLM design is one such opportunity for future work. Some questions that could be investigated are: What types of patient inquiries are made by interprofessional teams in the domain of HIV/AIDS care? How will users access patient information in the simulation and how will this information be stored, managed, and governed? How should case information be presented: as richly presented information in narrative form, as a series of notes, or some combination of these and other methods?

In addition, research is needed to produce a model of a health and social care for HIV/AIDS. Such a model would be useful as a basis for evaluating care interventions. However, because interprofessional education is interested in promoting process innovations, users should also be allowed to generate new models through experimentation with organizational change: for example, by making novel changes to existing institutional rules and conventions and observing the effects of those changes on the system as a whole. Providing this opportunity for organizational learning requires research on how to facilitate user experimentation with organizational development.

Research is also needed on the types of caregivers and helpers that should be made available by the simulation to support interprofessional learning and practice. Moreover, how will intelligent agents be made available and how should user-agent and user-user interactions be supported?

There is also a need to produce realistic problem cases to provide opportunities for experiential learning and to explore the potential of using cases to inform individual and group decision making and thus support learning within the multimedia simulation (Jonassen, 2002; Kolodner, 1997).

Finally, the activity theory-based method proposed in this thesis was useful in this study. Combining activity theory with grounded theory techniques help to systematize the process for illuminating structural tensions. Although this method is still in the early stages of development, its usefulness in this study suggests that, with some refinements, it could provide an effective way to inform future cycles of design work.

6.3 Conclusion

This study was originally conceived to inform the design of a multimedia simulation for interprofessional learning. In addition to identifying opportunities for research and development, this work has also contributed to four areas of research. To activity theory, this work contributes a method for producing grounded structural explanations for problems occurring in human activity systems. To design-based research, this work contributes a method for identifying design issues in learning activity and thus suggests an approach for guiding design experimentation. For designers of simulations and games for learning, this work suggests an approach for investigating learning and instructional needs in educational domains that are not yet well understood. In addition, the findings of this work contribute to a better understanding of the possible effects of particular PBL designs on interprofessional learning, which may be of interest to instructional designers, educators, and researchers in the field of interprofessional education.

The next step in the HEALTHSIMNET project is to actualize a testable design based on these initial findings and to develop that design through design experimentation. The goal is to develop a simulation that not only makes the experience of interprofessional learning more meaningful and enjoyable for learners, but more importantly, to contribute to improving the ways that health and social care professions work together for patient care.

APPENDICES

Appendix A: Transcript of Observations

Line	Participant	Action
01	Nutrition	Lists today's learning objectives and assigns work to team members
02	Tutor	Introduces topic of HIV surveillance
03	Nurse	Joins discussion about HIV surveillance
04	Tutor	Asks team about treatment guidelines
05	Pharmacy	Presents his research on treatment guidelines he found in an article
06	Medicine	<i>"I'm sure it's from the WHO..."</i>
07	Tutor	<i>"WHO is written for developing countries...There are a lot of guidelines and it's hard to know which ones apply to which jurisdiction...Guidelines get updated every two years...It's good to follow the local guidelines...WHO tends to be more restrictive."</i>
08	Pharmacy	<i>"Drugs for bipolars depend on the situation, patient SSRI, mood stabilizers, anti-psychotics..."</i>
09	Nurse	Talks about her recent experience working with a pharmacist and what she learned about drug interactions
10	Medicine	<i>"ARDs interact with everything. That's what a pharmacist told me."</i>
11	Nurse	<i>"Were there interactions?"</i>
12	Medicine	<i>"He said sometimes the interactions are overlooked."</i>
13	Tutor	Informs team about specific drug interactions. Gives reference to a website for more info about drug interaction issues.
14	Nutrition	Presents her findings on learning issue: addiction and nutrition.
15	Social Work	Presents her finding (article) on learning issue: mental illness (mania) and substance abuse (alcohol)
16	Nurse	<i>"Are they at more high risk behaviour when on drug or alcohol use?"</i>
17	Social Work	<i>"Addicts are at high risk for [HIV] infection..."</i>

Line	Participant	Action
18	Nutrition	<i>"[We] need to make sure they meet their energy requirements, otherwise they will be weaker."</i>
19	Nutrition	<p>Presents the next PBL question:</p> <p><i>"Three years elapse and Jason has had routine monitoring. He suffered a bout of viral pneumonia 2 years ago but he has been otherwise well and his counts acceptable. Today, he has come to the team for a check-up.</i></p> <p><i>His CD4 count = 300cells/mm3 and VL > 100,000copies/mL. His weight has dropped to 73kg.</i></p> <p><i>What are the treatment implications?"</i></p>
20	Nutrition	Introduces topic of AIDS wasting syndrome
21	Medicine	Attempts to help nutrition student with definition of AIDS wasting syndrome
22	Pharmacy	Joins discussion about what constitutes AIDS wasting syndrome
23	Tutor	<i>"How do you define wasting in this situation?"</i>
24	Nurse	Provides a technical definition of wasting
25	Nutrition	<i>"There's three years of missing information...three years was a long time. Also, his weight at the beginning could have been considered obese..."</i>
26	Tutor	Points out that there is a formal criteria for AIDS wasting syndrome and suggests it as a new learning issue
27	Pharmacy	Asks tutor for definition of an AIDS defining illness
28	Tutor	Lists and explains the four stages of illness
29	Social Work	<i>"[we should] take a step back and look at his history. There is a high chance he has other issues...If we have a better profile of him, we can treat him better."</i>
30	Social Work	Begins reading patient's existing profile out loud
		<i>"Jason is 24, he recently broke up with his partner..."</i>
31	Nurse	Agrees with Social work. Suggests that Social work leads task of creating patient's social history
32	Tutor	Asks how patient's social history will affect his treatment
33	All	Team agrees that Jason's history will influence treatment decisions, so they decide that Social work should take on task of constructing Jason's social profile.
34	Social Work	<i>"I'm feeling uncomfortable with my role, having no background as a Social work..."</i>

Line	Participant	Action
35	Nurse	<i>(talking to the tutor) "Is there something you know that we don't know?"</i>
36	Nutrition	<i>"Will we need to have [a complete patient profile] for the final assignment?"</i>
37	Tutor	<i>"No...It's not important that you construct the whole patient...We just need enough to talk about the considerations..."</i>
38	Pharmacy	Asks whether the patient should be on ARVs
39	Nurse	Agrees that their patient should eventually go on ARVs
40	Pharmacy	Points out that they need to first inform their patient about the risks and benefits of ARVs
41	Medicine	<i>"We should be looking at first-line drugs..."</i>
42	Pharmacy	<i>"I'll look up first-line drugs..."</i>
43	Nurse	Raises issue of whether patient already knows about ARVs <i>"I want to know how well informed he has been..."</i>
44	Medicine	Asks nurse why she thinks its relevant to know that information
45	Nurse	<i>"I want to know if he has friends that have been on ARVs...No need to overreact at this point about resistance to ARVs...and liver issues"</i>
46	Tutor	<i>"Have you talked about support groups for Jason yet?"</i>
47	All	Group indicates that they have already talked about support groups
48	Tutor	Presents some hypothetical situations regarding patient response to treatment discussion. Points out that the treatment plan will be determined by many factors, one of which is the stage of illness.
49	Nurse	In response to the tutor, she suggests that they should try to connect their patient with other patients who have experience with using ARVs
50	Pharmacy	Points out that the team needs to first create list of things that they want to know about the patient
51	Nurse	Suggests that they should investigate complementary therapies
52	Pharmacy	<i>"I'll look up the drugs and their effect on the liver."</i>
53	Nurse	Shares story about the effects of drugs on the liver
54	Nurse	Talks about considering complementary therapies
55	Tutor	Asks team to consider the course of action if the patient agrees to treatment
56	Nutrition	<i>"I want to know about food and drug interactions...I'll look at that."</i>

Line	Participant	Action
57	Tutor	Suggests that team needs to know how to build therapeutic relationships
58	Tutor	Suggests that team needs to know about reactions to medical cocktails
59	Nutrition	Suggests that care providers get more out of developing a long term relationship with the patient
60	Tutor	<i>"It's not clear on when to start therapy. It depends on the individual and where they're at. By pushing it, you might be creating a problem."</i>
61	Social Work	<i>"I feel that I can't get involved because [the discussions are] very medically oriented. I'm not sure what my role is...I'm interested in his mental state. I'm interested in his [social] history for this reason!"</i>
62	Tutor	Addressing the social work student, he restates that she can take on the task of creating patient's social history
63	Nurse	Agrees that it is critical that someone create patient's social history.
64	Social Work	<i>"I feel that I can't do my job [without a social history of the patient]. I've been trained to have that information before I can do anything."</i>
65	Tutor	Leads discussion to a close and asks team about next steps
66	Social Work	Reminds team that they need to create a report for the course, so they may need a good description of the patient
67	Social Work	Tells team that she will work on creating a story for their patient
68	Nurse	<i>"Has anyone been with their disciplines yet?"</i>
69	Social Work	<i>"No. This has been more about the medical aspect..."</i>
70	Nurse	<i>"Would it help to make a (patient) history?"</i>
71	Social Work	<i>"It should be a group discussion. It can be any profile...I need it so that I can have something to refer back to..."</i>
72	Social Work	<i>"I created a profile for Jason...His mom and dad live in Toronto...Mom is supportive...dad isn't...He used to have a lot of close friends, now he just has two..."</i>
73	Pharmacy	Presents research on ARV treatment
74	Nutrition	Asks team what drugs Jason is/will be on
75	Medicine	<i>"He doesn't want to go on drugs and is that ok?...If he's not ready, then we can't push him."</i>
76	Nurse	Agrees with medical student
77	Social Work	<i>"What is his plan in terms of nutrition?"</i>

Line	Participant	Action
78	Nutrition	Responding to the social work student's question, she suggests some considerations for a nutrition plan
79	Tutor	Asks team to consider known risks regarding treatment
80	Social Work	<i>"Remember that Jason is an alcoholic..."</i>
81	Pharmacy	Presents the next PBL chapter: Day 4 - the unstable phase <i>Jason comes in 3 months later with a note from his psychiatrist reading, "I'm concerned that Jason is non-compliant on his Epival and has opted for complimentary therapies to treat his HIV."</i> <i>His most recent CD4 count = 150cells/mm3 and his VL is > 50,000copies/ml. He weighs 62 kg.</i> <i>What are your concerns about Jason's health? What are your treatment recommendations?</i>
82	Nutrition	Wants to know his initial weight in order to determine whether he can be diagnosed with AIDS wasting syndrome.
83	Social Work	Inquires about criteria for AIDS wasting syndrome.
84	Nurse	Explains to Social work that Jason is considered to be wasting
85	Nutrition	Asks for Jason's height in order to calculate BMI
86	Pharmacy	<i>"We need to educate him about adherence issues..."</i>
87	Nurse	Suggests that team should show Jason "tough love"
88	Social Work	<i>"We want to find out why he's not taking his ARVs...is it his depression?"</i>
89	Tutor	<i>"Why do bi-polars not like about taking the meds?"</i>
90	Social Work	<i>"If he's in a manic state, he may be at high risk of spreading the disease..."</i>
91	Medicine	Suggests that someone exhibiting risk behaviour should be put on prophylactics
92	Social Work	Asks for definition for "prophylactics"
93	Medicine	Explains the purpose of a "prophylactic"
94	Pharmacy	States Jason's biomedical condition
95	Medicine	Reminds team that Jason has AIDS wasting syndrome
96	Tutor	Attempts to elicit a medical criteria for AIDS
97	Tutor	Asks team about their other concerns

Line	Participant	Action
98	Social Work	States "mental health" as her concern
99	Social Work	"Should you do a test at this point to see if his mental health is impacting on his physical health?"
100	Nurse	"...Is he eating, does he have food?"
101	Tutor	Suggests that Jason may not share the same goals/concern(s) with the care team
102	Social Work	"Can we hospitalize him to get him back on his medication?"
103	Pharmacy	"He might just be couch surfing..."
104	Nutrition	"What about social concerns...How is he living?"
105	Social Work	"Jason [was] working... he's now on social assistance..."
106	Social Work	"That's something social work does...help with social assistance..."
107	Pharmacy	"Helping him get 'ministry money'!"
108	Social Work	"It's important to follow up to see if he's going to the support groups."
109	Pharmacy	"Does he need a fixed address to get support from Dr. Peters Centre?"
110	Medicine	"I heard that a lot of people don't like the Dr. Peter's Centre"
111	Social Work	"It really depends on who he is...there are other support groups as well"
112	Nurse	<p>Presents the next PBL question</p> <p><i>Jason refuses the team's recommendation of ART. He is not seen for 6 months at which time he presents to the ER, short of breath, complaining of a dry cough and fatigue.</i></p> <p><i>He is "sattng in the 70's".</i></p> <p><i>What Opportunistic Infections are you concerned about?</i></p>
113	Nurse	Expresses concern over "PCP" pneumonia
114	Tutor	Asks the rest of the team to list their profession specific concerns
115	Medicine	Lists "oxygen" as a concern
116	Medicine	Lists "MAC" and "TB" as concerns
117	Medicine	Lists "bacterial pneumonia" as a concern
118	Social Work	Asks for definition for MAC
119	Medicine	Provides partial definition for MAC

Line	Participant	Action
		<i>"MAC is like TB..."</i>
120	Nurse	<i>"It's such a jump from [chapter] to [chapter]... Things have changed so quickly since the last time... It doesn't seem like what we did had any effect"</i>
121	Social Work	<i>"What we say doesn't make a difference... He just keeps going downhill."</i>
122	Nutrition	Reports about her findings on issue of tube feeding for Jason in palliative
123	Tutor	Challenges her findings about tube feeding
124	Pharmacy	<i>"If a patient can eat, I would give him whatever he wants"</i>
125	Pharmacy	Presents next PBL topic: Day 5 - downward and dying phase <i>"Jason undergoes a 2 week course of Pentamidine and steroids. He arrests once and cannot be weaned off the ventilator.</i> <i>His family requests a family meeting to discuss the options available. They have asked for aggressive management and do not want to "pull the plug". The team believes that all efforts are futile and that Jason should receive comfort measures only.</i> <i>Discuss how you would conduct the family meeting."</i>
126	Nurse	Initiates the discussion on palliative care and issue of near death
127	Nutrition	States the importance of helping patient to die with dignity
128	Pharmacy	<i>"I would explain to the family that we have done all we can"</i>
129	Social work	<i>"What is...pentamidine?...What is the ventilator for?"</i>
130	Tutor	<i>"Pentamidine is a treatment for PCP pneumonia...to keep him on a ventilator is just prolonging his life"</i>
131	Nutrition	<i>"If the team thinks he's going downhill, then maybe not"</i>
132	Tutor	Suggests that team should continue to look at tube feeding
133	Nurse	<i>"If he's dying, he would get nourishment through an IV"</i>
134	Social work	<i>"Maybe we should discuss the issue of a will or where his things should go"</i>
135	Nurse	<i>"It's been such a rapid digression..."</i>
136	All	Talk ensues about how to move forward with Jason's care given how close he is to dying
137	Nurse	<i>"So the family wants us to continue treatment?...Should we continue treatment or begin comfort measures?"</i>

Line	Participant	Action
138	Pharmacy	"We can tell the family that we did our best...and recommend comfort measures"
139	Social work	"The family is grieving at this point...They will probably want to continue treatment."
140	Nurse	"...But in a selfish way, they aren't thinking about Jason..."
141	Tutor	"You can try to explain to [the family] that nothing more can be done..."
142	Nurse	"Aren't we making assumptions?...Shouldn't we ask Jason what he wants?"
143	Social work	"...He decided not to do this, and we shouldn't make any assumptions about what he wants..."
144	Tutor	"Your job is to inform [the family]...and to support them..."
145	Nurse	"...Isn't that something a social worker would do? To assess the relationship?"
146	Social work	"Remember that his mom is the only one involved..."
147	Nurse	"What about power of attorney...should we be looking at that here?"
148	Tutor	Suggests learning objectives: Health Care Consent Act, power of attorney, substitute decision making
149	Nurse	Reminds team about the case heard in class about the Chinese son who was trying to make decisions on behalf of his mother
150	Tutor	"What can we do to inform them and support them, let them know that treatment is futile?"
151	All	Team members provide their input about what can be done
152	Tutor	Provides a few suggestion on what can be done
153	Social work	Raises issue about what to about the conflict between family's wishes and the team's recommendation
154	Tutor	"Is it [the family's] decision or the team's decision?"
155	Pharmacy	"Personally, I think it should be the family's decision"
156	Nurse	"...we should give them that chance..."
157	Social work	"Yeah, I think we should let the family know the facts so that they can let us know their decision..."
158	Tutor	"However...we need balance because it's a huge burden for the family..."
159	Nurse	Initiates topic on "do not resuscitate" (DNR) and gives an example.
160	All	Questions about DNR
161	Tutor	Explains DNR orders and points to the web as a place to find out more information about

Line	Participant	Action
		DNR
162	Nutrition	Asks a question about 10C palliative care
163	Tutor	Explains DNR and it's relationship with palliative care
164	Nurse	Participates in discussion about DNR and palliative care
165	Nutrition	Participates in discussion about DNR and palliative care
166	Social work	Participates in discussion about DNR and palliative care
167	Nurse	Questions the concept of DNR by telling a story about someone who wanted to die, but didn't
168	Nutrition	States that she talked to a few nurses, and they felt that they would be overridden on issues of DNR despite their experience
169	Tutor	<i>"...it's possible that not everybody on the team agrees, it happens."</i>
170	Nutrition	Raises topic of nurses being disempowered; gives example from her own experience
171	Pharmacy	Suggests how disempowerment can effect the patient
172	Nutrition	<i>"...we don't have control over what really happens with Jason..."</i>
173	Tutor	<i>"What is the role of the team in deciding Jason's care?"</i>
174	Social work	<i>"I think they would just follow the doctor's decision."</i>
175	Nutrition	<i>"...he was missing for three years, so who was responsible for that?"</i>
176	Social work	<i>"So why was he missing?...who's responsible for him in a situation like that?"</i>
177	Nutrition	Enters discussion about missing epidemiological information
178	Pharmacy	Introduces issue of debriefing the family
179	Tutor	<i>"What are your 'feelings' about what is happening?"</i>
180	Social work	Expresses feelings about the family's situation
181	Pharmacy	<i>"It's good the family was there. It gives them closure."</i>
182	Social work	Inquires about the boundary between patient and practitioner
183	Tutor	<i>"One of the goals of this kind of learning is to talk about the possibilities."</i>
184	Nurse	Inquires about how to debrief and console the family
185	Tutor	<i>"When should you discuss pastoral care?"</i>

Line	Participant	Action
186	Social work	<i>"We should have done that beforehand...before Jason died."</i>
187	Tutor	<i>"Sometimes social work and pastoral care overlaps. What would you (as the social worker) help [the family] with?"</i>
188	Social work	<i>"I could help the family cope with their loss...Help them with coping skills."</i>
189	Nurse	<i>"Do you think we need to request an autopsy?"</i>
190	Social work	Suggests that family might want to know cause of death. But suggests that his disease should be kept secret because of cultural attitudes towards AIDS
191	Tutor	<i>"What is the reason for an autopsy?"</i>
192	Nurse	<i>"Just curiosity...Can we reveal that he had AIDS after his death?"</i>
193	Tutor	<i>"That's something for you to look into. Look at whether family has the right to know about the cause of death...whether you can share the information with his family after his death."</i>

Appendix B: Interview Transcripts

A. Interview with a social work student from TEAM A

INTERVIEWER: Please tell me about the time you voiced your frustration over what was happening in the case.

PARTICIPANT: I think during the PBLs it seems as though from a social work standpoint that we...were jumping the gun and going right into the medical side of things and meds and treatments..., but without knowing our patient. And that is a big no-no in social work. You have to know your patient and you have to develop a therapeutic relationship. You have to have several forms, bio, psycho, social, spiritual. And we were going right into the medical. I felt that when I had incorporated that into the PBL, it was just overlooked.

They were like, that's not important right now. They were like, "we'll focus on that later, it's not important right now." So what was happening was I was getting kind of frustrated because I didn't know how to do my role because what would happen is we would all be talking about things and I would say this if I knew that, I would suggest this if I knew that. So when I left after one of the sessions, I said I really need to assert myself and say okay, this isn't working and this is why. But I was leery because I didn't know if there was a reason why I wasn't given [that information]. Why the tutors were [saying], it's not important right now, and one of the tutors was a social worker. So I thought maybe I don't need to know this information because later on he's going to be in a hospital setting and then that is when my role is going to come in because he's in a hospital and I [could say] that I know his family and suddenly my role would [be to] look after his funeral arrangements or something. I tried to figure out that, but it still kept going back to he's bi-polar and this and that and other people could [contribute to the discussion on whether] he should be in a support group, [etc]. But we live in the lower mainland so there are [many] options, so I was [thinking] that it could be any support group.

INTERVIEWER: Have things changed since you announced your frustration?

PARTICIPANT: Somewhat, but I feel that it is still under recognized...I feel that there's humour in the discussion now when it should be serious...but it is included now for sure. And even the [nurse on our team] said to me that she didn't know what social workers did until she went in and worked with a social worker yesterday and oh my gosh, [she learned] that they need to know this, this, and this. And I [thought], I know! So it has changed. I talked to three of the members and they wanted me to create the profile for the character, but that should have been done as a

group and I emphasized a couple of times that it should be done as a group, but I ended up doing just a general profile and it does work a lot better now. I'm a social worker and not in medicine or nutrition or anything like that, it's totally about the emotional well-being of somebody. That's what is really important.

INTERVIEWER: Did you have the resources (tools) you require to do your work?

PARTICIPANT: Jason has bipolar disorder, there are correlations between bipolar disorder and substance abuse; there are correlations between bipolar disorder and HIV. Jason's gay, so there are some stereotypes you could make there. So it is easy to make assumptions in order to make a profile that you could expect to see. However, social workers are also trained not to assume anything, so it goes against that, but for this case we need to base it on something so, yeah there's a tool.

INTERVIEWER: How do you feel about having to construct your patient rather than having a patient constructed for you?

PARTICIPANT: I would have said that I would have liked to have construct the patient, but after my experience, I think that patient should be preconstructed.

INTERVIEWER: Do you have anything to add?

PARTICIPANT: In terms of the hierarchy of professions, it seems like the med students get a lot of credibility because they...know so much and they've been to school so long I think that everyone in the group and even myself feel inclined to listen. And so I think there is a hierarchy in that sense.

INTERVIEWER: So, do you think there is an over emphasis on the medical issues?

PARTICIPANT: Yes, I do.

B. Interview with Nutrition Student from TEAM B

INTERVIEWER: What was your concept of interprofessional collaboration before taking this course?

PARTICIPANT: So basically...in a healthcare setting, you have all of these professions that traditionally seem to be working separately. I whole purpose of the interdisciplinary aspect of the course was to help us develop respect for each of the professions and their roles in the

healthcare system. And realize that each member of the healthcare team has an integral role...and its important to utilize each person's expertise.

INTERVIEWER: Has that concept changed for you since the beginning of the course?

PARTICIPANT: Not fundamentally, no. I definitely understand more how each role is integrated, especially social work and even dietetics over the course of the last four weeks. It's pretty evident the kind of hierarchy that exists right now.

INTERVIEWER: Can you elaborate on that?

PARTICIPANT: When I was in IDC or 10C...maybe not so much IDC, but 10C. I followed the dietician around for the entire day and she talked to maybe three other professionals, one of which was the dietician. The other two were a doctor and a nurse. But that was in passing. She was writing something and she overheard a conversation that they were having. For me, I was there and I thought this was not very interdisciplinary. It was distressing in a sense, but on the other hand, when I went to Oak Tree, and it's the standard for interdisciplinary work and they are always talking to each other. I worked with Diana for a day and every few minutes, because there were always patients circulating, every few minutes there would be a pharmacist coming in and talking about the client and then the social worker would come in and then the nurse would come in and they would always be talking about the client.

INTERVIEWER: Maybe not everyone will get a chance to experience what you experienced at Oak Tree. For those people, do you think what you are learning in this course will prepare them for interprofessional practice?

PARTICIPANT: For me, I realize from being at 10C how little the dietician interacted with the other professions. Knowing that, seeing that, I can recognize it when its happening and hopefully in recognizing it I can be proactive and...hopefully help the other professional to realize that [dieticians] do have an important part in the health care system...

INTERVIEWER: Do you think this course has prepared you to promote interprofessional collaboration in settings where it is not happening as much as it should? For example, in 10C?

PARTICIPANT: We haven't been trained on how to do that, but what I have learned is that you need to speak up more. I think that's the best

way to do it. The more you speak up, the more they may realize where they're going with this.

INTERVIEWER: Do you feel that you play a big enough role in the treatment of your patient or do you feel that your role is utilized at the proper times?

PARTICIPANT: It's kind of hard to answer that question I think we had a really good team, the only thing that was kind of out of our own control was the way that the case was set up. We were just discussing this, that it was very medically and pharmaceutically based and we were waiting for them to talk about the nutritional status or even the social work aspect. And at no point did they even touch on it. It was always medical or always with the drugs and that sort of thing. So it's hard to answer that question in this context. But if he had been given the opportunity to talk about the social work more or the nutrition more, then we would for sure be represented more appropriately.

INTERVIEWER: What resources, if any, did you feel were lacking in the PBLs?

PARTICIPANT: As I said, we did not have any nutritional information whatsoever, it was always his medical condition.

INTERVIEWER: So would you prefer to have the patient's complete history or profile information fully constructed beforehand?

PARTICIPANT: Maybe not fully constructed, its nice to have the flexibility, but for sure you need to give something to work with. It was hard because the clues that they were given us were always medical and there was never anything from a nutritional standpoint so I was always giving very similar recommendations because I had nothing else to go on.

INTERVIEWER: What tools could they give you that might help you with your role or how could they have set things up differently?

PARTICIPANT: We have been discussing this one as well. Again, it was very medically based so the sentiment in our group was that they did not put enough emphasis on nutrition and social work. I mean I think that with social work, we got a lot from the lectures and that sort of thing, but nutrition was definitely lacking. We only had one lecture on it and it was an hour and a half or an hour and forty minutes a few days ago. Up until that lecture, [nutrition] was even mentioned...we didn't talk about it until the lecture and after the lecture, the same thing; we haven't really talked about it. It's kind of funny because it seems that nutrition is so important

to people with HIV and AIDS, yet we don't think to emphasize it in the course. So I thought that was kind of funny. It's good to place the emphasis on the medical side...but I take the holistic perspective. I mean you can take your drugs and meds...but if you're not eating the right things with those drugs...it's not going to be effective. So I think there needs to be more emphasis.

C. Interview with Pharmacy student from TEAM B

INTERVIEWER: Were there any conflicts in the PBL meetings?

PARTICIPANT: At times, there were differences about how we should approach things. None of us really had a total grasp on the disease stages. Most of it was based on our own take or what we had taken from our clinical experiences. Also, we're all at different levels and at some times there were disagreements, but usually, I think we were able to come to a consensus and voice why we felt the way we did and generally we would agree.

INTERVIEWER: Were there any situations where you felt that maybe your role wasn't being utilized?

PARTICIPANT: I felt that for the most part I felt that I got along well with the team and I think we trusted each other and trusted each other's knowledge. Like I wouldn't know about the diagnosis, what the med student does, or I wouldn't know a lot about the nutrition so for the most part I would take their word on things unless I really knew otherwise. I think for the most part that they agreed as well.

INTERVIEWER: Do you feel that this course has contributed to any change in understanding about what interprofessional collaboration means?

PARTICIPANT: I think it has stayed the same. It just has been a different experience than I've ever had. I've done PBL before but it has just been strictly pharmacy so we would be collaborating on the same issues, like drug therapy or drug related problems, just everything from a pharmacy perspective. But now what we are collaborating on is different. We're focusing on the whole patient and the whole problem and basing decisions on everybody's input. The experience was different, but my view of collaboration is still the same.

INTERVIEWER: Did you feel like the case you handled in the PBL was realistic?

PARTICIPANT: I felt like it was. I mean, assuming that down the road we would all have more knowledge...in that way, it would change slight as to

what we could all add to the decision making process. With our team, we didn't have a nurse...we had an interdisciplinary student instead so I think that changed the dynamics slightly because we had a gap in the roles that should be contributing. I really felt like after observing teams in action in the hospitals or clinical settings that our team was very similar.

INTERVIEWER: With regards to your patient, did you feel that you had enough information to make decisions? Would you have preferred to have the patient and his story more fully developed?

PARTICIPANT: There were times during the PBL process where we all felt very frustrated because there wasn't enough information given to us and at that point in time it wasn't working for us to not have been given that information. But for presentation purposes, I felt that it was nice being able to make the patient up. It was just like when we were discussing things it would be all 'what ifs?' Like 'what if he's a drug user' or 'what if he's homeless' and in that sense we couldn't form conclusions during the PBL process...

INTERVIEWER: What do you think of a... computer simulation that would allow you to test group interventions and to receive feedback? Do you think this would improve the learning experience?

I think it would, I think it's a neat idea because for me...I've been finding [that] it's going to be hard to apply this to job experience...because I don't think I know enough to be coming up with these drug therapies. To me, it's fairly random it seems so it would be nice to be able input my recommendation and then to have feedback on whether it was appropriate, what happened to the patient. For me it would be a learning tool that could be helping for making the transition from being a student to being in the health care profession.

D. Interview with nursing student from TEAM A

INTERVIEWER: Were there any conflicts or times when you felt your role was well utilized during the PBL meetings?

PARTICIPANT: Not necessarily, but I think there were times throughout the problem based cases or lessons where our discipline did seem to be as prominent. But then at the next stage, it would be more relevant. Initially, the [role of nutrition] didn't seem very apparent in the beginning, and more into the middle stages, I know that the social worker's role wasn't being utilized effectively. As far as my profession, I'm not sure, but maybe because it seems to touch on all of [the other areas], I didn't notice it as much, but I know that others did.

INTERVIEWER: What was your concept of interprofessional collaboration at the beginning of the course, and has it changed since then? Maybe we could start with your original conception of interprofessional collaboration.

PARTICIPANT: It's when different disciplines are working together toward the same goal. In my experience, I work in an operating room, the disciplines are the surgeon and the nurses, as well as the anaesthesiologist and the perfusionist, but all of us are working together. Our roles seem very much separate, but at the same time, each role contributes to the same outcome. In terms of this, it's the same idea. I can see it more clearly now as this course has been progressing, than when I first started it because there were some aspects, such as social work, that I have never been really clear on what they do. It has become very apparent to me now and I can see, as it concerns the topic of HIV and AIDS...you can see how all the different professions do come together for work in the best interest of the patient.

Maybe not right away, it takes practice, it takes experience just trying to figure out how to utilize each discipline, to make your role prominent, I think it would just come with experience. Right off the bat I wouldn't be able to execute as effectively as I've seen the nurses and doctors on my clinical visits deal with it.

INTERVIEWER: What are your thoughts about the amount of information provided by the case? In other words, would you prefer to have the patient's case story more fully constructed beforehand?

PARTICIPANT: I think in a sense I wish it was preconstructed because first of all, there were a couple of sessions where I feel like we were not filling in the blanks. Even the...tutor, one of them didn't even know that we were supposed to be filling in the gap as far as constructing this person and didn't think it was necessary and therefore didn't encourage integration of it into the problem-based lessons. But at the same time, we took it upon ourselves...to piece together this patient. The next time though,...what we fictitiously constructed before conflicted with what we were dealing with the next week. Like obviously, we don't know what we would be looking at, so in a way, yeah, it would have been easier had it been done ahead of time.

INTERVIEWER: Was this a barrier to learning how to work with other professions to care for your patient?

PARTICIPANT: It wasn't so much a barrier, but a lot of detours. We mostly got there, but instead of taking the straight road, we took lots of curves and stuff.

INTERVIEWER: Do you think it would have been helpful if you could evaluate the interventions you formulated?

PARTICIPANT: Sure, most definitely. It would be something more tangible than what is put on a piece of paper. [Right now] it's very evasive. We're now trying to fill in the blanks and collectively try to figure out who the [patient] is. To have a patient right in front of us, to tell us who he is, assuming that he would know ahead of time the direction the case was going...he could fill us in on a need to know basis.

E. Interview with medical student from team B

INTERVIEWER: What was your role on your PBL team?

PARTICIPANT: It has shifted since the start. They made the medical student the mascot the first day. We would talk less because we have personalities where we like to dominate conversations. I was the facilitator. So I played that role. I'm used to varying my role in PBL. And I've actually been quite quiet in the PBLs to get away from the traditional stereotypes; the doctor is always in charge type thing. I've been quite quiet and initially, when I would interject to explain medical information, or the lifecycle of the HIV virus, or method of treatment, or things like that it would go in one ear and out the other. And so I [eventually] took a back seat approach. I helped to facilitate if there was an issue. And as people would come back with their own information, they learned it better anyways. It was funny because I would say that this is the treatment for whatnot, and then it became a learning issue. Then they would come back the next day and say the exact same thing as if it was a new discovery, which is the process of learning right? So I quickly learned that the best way to do my role was to vary it from my traditional role, which I'm used to doing in medical PBL, which is highly contributory to facilitating, just filling in any gaps that were there.

My expectation for this course initially was on how to medically treat HIV, which I already had a bit of in our first year, and this course gave us some of that. But it was about looking at the global or psychosocial aspects of care. I kind of realized as the course went on that the medical aspect wasn't much of a focus, so I contributed less medical information for that reason.

The whole point of the course is to [help students develop] an appreciation for the global care of an HIV patient with some aspect of each of the professions...I think that the main goal that the course directors had was to [help] each discipline learn more about their own discipline-specific concerns for HIV and at least have an appreciation for the rest of the disciplines.

INTERVIEWER: Were there tensions or conflicts?

PARTICIPANT: I felt that it was quite laid back and we were respectful of each other and supportive and what-not. The only conflicts that arose was

the one person in our group who was very specific about how they wanted things done. And I was surprised because that was something that was traditionally found with medical students. Sometimes, it was just about having to work around that to make the group function as a whole and not necessarily just responding to [individual] requests.

INTERVIEWER: Has the course done anything to help you deal with these types of conflicts?

PARTICIPANT: Yes and no. For example, not just in the PBLs, but in the classes, there have been a lot of negative comments that have come out about the medical profession based on the traditional approach of how things were done. From time to time, people say this doctor did that or that doctor did that, and it's the only profession that had been criticized throughout the whole course. Nothing bad has been said about social workers, or about dieticians, or about nurses so there is a little bit of resentment that comes out of that.

INTERVIEWER: Why do you think that is?

PARTICIPANT: Probably because of the paternalistic view of medicine, or how it was I should say. Because we are taught completely different now. So the statements that have come up about how doctors are trained are completely unfounded. Part of it too is that doctors do have a lot of control. They talk about power issues and control issues, and it's just the way they assert that or the way that some people want to have more control over patients.

INTERVIEWER: Do you think it was a hindrance to PBL activity that your patient wasn't more fully constructed?

PARTICIPANT: Yeah, that was one of our main problems with the case. They intentionally left it vague, but it made it more difficult for us to learn because there were no specific objectives about what we were supposed to take away from the patient. We had no feedback on our interventions that we would initiate on the patient. The tutor had no tutor manual for when we were going astray or when we were doing something right or wrong or something that is preferred or not. So I think those three things made it difficult.

INTERVIEWER: Is there something we could add to the PBLs that could help?

The suggestion that we gave was...if they want to gain a better understanding of each discipline, instead of making it intentionally vague, make it intentionally specific, and discipline specific. So we thought it would be more beneficial if we have five days, [and on each day] you go

into each discipline. The way the case was presented, it was presented in a medical fashion, and there is basically nothing about nutrition except for BMI. There was very little about social work except for marginalization and vulnerability. And nursing, we didn't have a nurse in our group so it was kind of difficult for us to see where a nursing would play in it. So we thought that if we actually went deep into each one, we would have a deeper appreciation of each one of the disciplines... instead of having this vague nebulous idea.

F. Interview with nutrition student from TEAM A

INTERVIEWER: Do you feel that your role was effectively utilized in the PBL meetings?

PARTICIPANT: That's a broad question. I think there's always a time for each person to give what they can to the group. I think when it was needed to be heard it was heard. I think it's difficult because we're talking about people who have been very focused on their own disciplines so their coming into this and it's their first interdisciplinary [experience]. And when we come into it, we don't know what other people's worlds were. This is a learning process, so I was trying to learn what the roles were first and it's kind of like doing two things at once. At first they probably weren't sure what I was doing, but now they do. Dietetics is a very hard thing to understand because it seems so basic, like eat your food. But it's not, it's quite complex, and they definitely understand that I have a role in it now.

I've grown immensely; I have such a better understanding of everybody's role. I didn't know what a social worker or nurse did before this, I kind of have an idea what a doctor does and a pharmacist, but even the doctor and the pharmacist I learn a lot more than that. And about PBL, it's one of my most favourite ways of learning. Instead of one way, you have a two way thing happening.

INTERVIEWER: Would you prefer to have your patient more fully constructed in your case?

PARTICIPANT: You mean the issue of [the social work student] not having enough information to work on? At first, we all thought we should have a person in mind because we can't work without having a person in mind, but as it went along, we found out that it worked out very well in the end. It allowed us to learn what other issues could have caused [the problems] so we learned a lot more that way.

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