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The Role of Collaborative Reflection in a Faculty Community

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The Role of Collaborative Reflection in a Faculty Community

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The Role of Collaborative Reflection in a Faculty Community

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A faculty community is a type of learning community where faculty learning and development is the focus. Previous research suggests that formally structured faculty communities promoted faculty engagement, improved teaching, thwarted career burnout, increased retention of experienced faculty, and fostered organizational change. Researchers have not examined faculty communities embedded in the workplace and the longitudinal effects these communities have on mid-career and senior faculty learning.

In this study, I examined how an experienced interprofessional faculty community of medical and biomedical professionals managed the implementation of a novel graduate curriculum in translational sciences. Translational sciences education aims to enhance the collaborations between scientists and clinicians for the advancement of patient treatment and care. I focused on how faculty advanced their individual and collective understanding of the curriculum implementation using collaborative reflection during weekly community interactions.

The study began at the start of the curriculum implementation and lasted fifteen months. It was a qualitative, ethnographic case study including three sources of data: naturalistic observation of teaching and faculty meetings, faculty interviews, and

community artifacts. Two theoretical frameworks undergirded the design of the study: community of practice and distributed cognition.

The results of the study suggest that collaborative reflection in the faculty community promoted faculty learning over time in several areas: teaching and instruction, assessment and evaluation, individual knowledge, student learning, and organizational and leadership skills. Collaborative reflection occurred in response to multiple episodes that occurred during curriculum implementation, but was focused primarily on facets of instruction, which was the dominant work of the community. Collaborative reflection enabled decision-making on instructional content and process, pedagogical content and process, and curricular content. A cyclical process of instructional development emerged in the community including: session planning, implementation, collective teaching observation, and collective instructional evaluation. Attributes of the community that emerged to support collaborative reflection included: shared goals, domain knowledge, and mutual trust. The community provided a shared social context for systematic collaborative reflection and scaffolding in instructional development.

The study findings represent a specific set of experiences that may inform a model of instructional development for use with interprofessional faculty communities in academic health centers.

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CHAPTER 1

INTRODUCTION

> *A community creates the social fabric for learning. A strong community fosters interactions and relationships based on mutual respect and trust. It encourages a willingness to share ideas, expose one's ignorance, ask difficult questions, and to listen carefully. (Wenger, McDermott, & Snyder, 2002, p. 28).*

A faculty community is a type of learning community where faculty learning and development is the focus. Previous research suggests that faculty communities improved teaching, reduced isolation and increased retention of experienced faculty through thwarting career burnout (Cox, 2004; Lenning & Ebbers, 1999; Ward & Selvester, 2012). Other literature suggested that communities foster organizational change through communication of the values of the organization, setting standards for faculty performance, leveraging institutional resources, enhancing innovation, or spurring creativity (A. L. Brown & Duguid, 1991; Cox, 2004; Cross, 1998; Eddy & Garza Mitchell, 2011; K. H. Gillespie, 2001; Shulman, Cox, & Richlin, 2004; Wenger et al., 2002; Wenger & Snyder, 2001). There is a small body of research on the role of faculty communities for faculty development in higher education. Most of this literature has focused on structured faculty communities that were formed for a limited period of time, such as one year, and not embedded in a practice context (see Cox, 2004). Researchers have not examined faculty communities embedded in the academic health center workplace and the longitudinal effects of these communities on mid-career and senior faculty learning and development.

Faculty development programs may include a range of activities that assist faculty in the performance of their academic duties, along the career continuum from entry-level faculty orientation and teaching improvement activities, to personal and organizational development,

(e.g. continuous institutional learning through shared values and mission), or mid-or late career activities that focus on faculty renewal (Benor, 2000; C. Bland & Schmitz, 1988 ; Centra, 1978; Irby, 1993; Menges, 1985; Menges, Mathis, Halliburton, Marincovich, & Svinicki, 1988; Yvonne Steinert et al., 2006; Wilkerson & Irby, 1998). Faculty communities formed for the purpose of faculty development, for example, may focus on using technology in the classroom or learning new instructional methods. More recently, researchers have described *faculty thinking communities* (FTCs) that form within faculty development programs (Eddy & Garza-Mitchell, 2011). These particular faculty communities continue to meet and collaboratively reflect on their teaching practice after the structured faculty development program ends.

Collaborative reflection is the process of reviewing one's experiences with colleagues, whether in a small group, with a peer, or through observation and discussion (Cooper & Boyd, 1998). Collaborative reflection is effective because it offers multiple perspectives from multiple sources (Mann, Gordon & McLeod, 2009). A faculty community can contribute to professional development through reflection and collaboration between peers that is based in inquiry and evaluation (Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

Collaborative reflection is a mechanism for peer guidance. Membership in a faculty community affords enduring occasions of peer guidance that may not be available outside the community (Billett, 2002). Peer guidance comes through sharing common problems or dilemmas with colleagues and receiving advice or suggestions from them (Brookfield, 1995). A recent study reported that guiding, directing, and proposing alternatives about teaching were two dominant characteristics of collaborative reflection during medical faculty meetings (Tigelaar, Dolmans, Meijer, & Van der Vlueten, 2008). Previous research on collaborative reflection with

experienced faculty also suggests deeper satisfaction with learning, enrichment in teaching, and deepened personal relationships; however, collaborative reflection on teaching can be a highly emotional process (Castle, Drake, & Boak, 1995; Martin & Double, 1998). While time consuming, faculty reported collaborative reflection worthwhile, dependent upon the level of trust and the quality of the feedback from colleagues (Martin & Double, 1998).

In this study, I examined how an experienced interprofessional faculty community of medical and biomedical professionals managed the implementation of a novel graduate curriculum in translational sciences. Translational sciences education aims to enhance the collaborations between scientists and clinicians for the advancement of patient treatment and care (Rubio et al., 2010). Specifically, I focused on how faculty advanced their individual and collective understanding of the curriculum implementation using collaborative reflection during weekly community interactions. I hypothesized that faculty who engaged in collaborative reflection within the community would learn and advance their understanding of the program implementation. Two theoretical frameworks guided the conceptualization and research design: community of practice and distributed cognition. The study sought to answer the following research questions:

1. What community activities were triggers for collaborative reflection?
2. What is the role of collaborative reflection for advancing faculty members' understanding the innovative curriculum implementation?
3. What do community interactions reveal about the nature of faculty learning in practice?

I began the study at the start of the curriculum implementation and collected data for fifteen months. The study sample was a convenience sample including all members of the

community with whom I was a participant-observer, four faculty members, and seven students. While the lens of the study focuses on faculty, the students' interactions influenced faculty work and are referenced. The study included several sources of data that were originally collected as part of a program evaluation. The primary data included: (1) field notes and memos from meeting attendance and observations, (2) teaching observations, and (3) an examination of archival community artifacts, such as instructional planning documents, agendas, and curricular artifacts. A secondary data source was ethnographic faculty interviews conducted after the first year of program implementation.

Chapter Overview

The literature review is organized into three separate chapters, Medical Education, Faculty Development in Medical Education, and Reflection. Medical Education, Chapter 2, describes the typical structure of a medical education curriculum and how the competency-based curricular innovation implemented herein differs from predominant medical education pre-clerkship model. Chapter 2 provides important background to the study and the implications for the work of the faculty community in training biomedical and clinical researchers.

Chapter 3, Faculty Development in Medical Education, reviews the emergence of faculty development in medical education and an overview of the prevalent concepts, activities, and approaches used. The purpose of Chapter 3 is to provide a conceptual background on faculty development activities before focusing on one approach to faculty development, *faculty communities*. Chapter 3 draws from seminal faculty development literature in both medical education and higher education. Chapter 3 also includes the theoretical basis for the study. In total, the chapters on medical education, faculty development in medical education, and faculty

learning communities provide a comprehensive background for this research. Chapter 4, Reflection, reviews the literature on reflective practice models in professional education and collaborative reflection research in particular.

Chapter 5, Methods, describes the formation of the community, participants' backgrounds, the innovative curriculum, and the research and data analysis methods. Chapter 6, Results, details the results of the analysis in response to each of the research questions. The results are organized by episodes, which constituted the unit of analysis. Episodes are the work activities related to curriculum implementation that were triggers for collaborative reflection within the community. The episodes were organized by theme, sequentially over time, and compared across themes to reveal the interconnections between each theme. The results of the episodic analysis were analyzed in the context of two reflection models. Chapter 7 includes discussion of the results, as well as addressing some of the limitations, practical and theoretical implications of the research.

Chapter Summary

Successful implementation of translational sciences education rests, in part, on clinical and research faculty working together to leverage their educational and scientific expertise. A faculty community provides a framework for studying this interprofessional collaboration and understanding the role of collaborative reflection in practice. This study may be of interest to faculty development researchers, program evaluators, higher education institutions implementing new interprofessional programs with medical and graduated students, or any faculty who may be interested in participating in a faculty community. The study findings represent a specific set of experiences that may inform a model of instructional development for use with faculty

communities in academic health centers.

CHAPTER 2

LITERATURE REVIEW

Medical Education

Medical education has evolved from an unstandardized, unregulated, apprentice-based model prior to 1900, to a structured model of education requiring advanced understanding of the basic sciences, as well as increasing immersion in, and responsibility for, patient care (Cooke, Irby, & O'Brien, 2010; Cooke, Irby, Sullivan, & Ludmerer, 2006). While a complete history of medical education is beyond the scope of this project, this section provides the educational context for the study for a faculty community implementing a program testing a new approach to interprofessional education. This approach partnered medical students and graduate students for one year of coursework within the pre-clerkship period, and monthly until the completion of medical school.

A description of the historical report *Medical Education in the United States and Canada* (Flexner, 1910) highlights the source of the current structure of medical training. I then review common curricular models in undergraduate medical education (UME; Years 1-4). While it seems counterintuitive to consider medical education as *undergraduate education* since it is typically completed *after* a bachelor's degree in the biological sciences (e.g. a pre-med program), the designation as *undergraduate* medical education (UME) distinguishes medical school from postgraduate medical work, or residency.

This review provides a perspective on how instructional approaches have adapted over time to accommodate the integration of new scientific knowledge within the pre-clerkship period. The chapter concludes with a summary of the most recent report of the Carnegie Institute, *Educating Physicians: A Call for Reform of Medical School and Residency* (Cooke et

al., 2010). It is relevant to this study of a faculty community, as the program implemented differs from the typical medical education structure.

The Flexner Report

Medical education during the 19th and early 20th century in the United States was "utterly unregulated" and "of poor quality" requiring a high school diploma and a variable period of apprenticeship (Shulman, 2010, p. vi). While a number of medical schools existed prior to 1908, including the College of Pennsylvania (University of Pennsylvania, 1765), Harvard (1782), the University of Michigan (1850), and the University of Texas Medical School (1891), not all medical schools offered a university-based structure.

Johns Hopkins School of Medicine, established in 1893, offered a four-year curriculum, requiring laboratory and clinical clerkship periods taught by full-time research faculty (Ludmerer, 2011). A college degree was required to demonstrate the attainment of scientific prerequisites. With clinical instruction through rotations in the third year and patient care responsibilities in the fourth year, the Hopkins' medical education model was eventually emulated by other medical schools (Nutter & Whitcomb, 2001).

In 1908, Henry S. Pritchett, the first President of The Carnegie Foundation for the Advancement of Teaching, commissioned a report to explore medical education quality, partially in response to a request from the American Medical Association (AMA) Council on Medical Education (D. A. Barr, 2010; Cooke et al., 2010). Abraham Flexner, an educational scholar at the Carnegie Foundation, prepared the report on 155 North American medical schools.

The "caustic" report criticized the substandard educational approaches and lack of scientific rigor in medical education (Ludmerer, 2011, p. 9). Flexner identified numerous

challenges in medical education at the time including: unstandardized programs, underprepared students, unqualified faculty, limited science knowledge requirements, lack of integration between science and practice, and an emphasis on rote memorization (Cooke et al., 2010; Cooke et al., 2006).

Trained as an educator, Flexner held a "philosophy that resembled the progressive model of John Dewey in which students learned by doing, by solving problems, rather than rote memorization" (Duffy, 2011, p. 270). This philosophy was evident in the report recommendations. Flexner recommended that "formal analytic reasoning, the kind of thinking integral to the natural sciences" should be the center of physician training (Flexner, 1910 as cited in Cooke et al., 2006, p. 1339). Aligned with this position, the report identified five standards for medical education: (1) a bachelor's degree in sciences, (2) two-years of basic science instruction, (3) two years of supervised clinical experience, (4) experience in laboratory investigations, and (5) instruction by physician-scientists who spend time in both the laboratory and clinic (Cooke et al., 2010).

While standards for medical education were also developing at the American Medical Association (AMA) and the American Association of Medical Colleges (AAMC) at that time; Flexner's public report is credited as fundamentally altering the structure and requirements for medical education in the United States (D. A. Barr, 2010; Cooke et al., 2010; Cooke et al., 2006; Duffy, 2011; Ludmerer, 2011).

The Structure of Medical Education

Medical education includes a continuum of educational experiences from pre-medical school preparation in the sciences, undergraduate medical education (UME), step-wise licensure,

and graduate medical education (GME; residency). While it is counterintuitive to consider medical education as *undergraduate education*, since it is typically completed *after* a bachelor's degree in the biological sciences (e.g. a "pre-med" curriculum), the designation as *undergraduate* medical education (UME) distinguishes medical school from postgraduate medical work, or residency. Residency, or postgraduate medical training, is three to five years of required training beyond medical school, depending on the clinical specialty. Professional learning thereafter is referred to as continuing medical education (CME; Accreditation Council on Continuing Medical Education, 2012). In total, training to become a physician spans a period, on average, of seven ten years, depending on the school, curriculum, prior pre-medical school coursework, and residency.

Learning does not end here. A practicing physician is expected to continue learning throughout his or her lifetime in order to keep pace with changing technologies, scientific advances, patient care, as well as licensing requirements. Alternately, physician scientists (i.e. MD/PhDs) may pursue a professional path dedicated to both clinical research *and* practice, although the balance of the two varies (see Brass et al., 2010).

Understanding the structure of medical education is important to this study because traditionally biomedical scientists and future physicians are not trained together. The competency-based curricular innovation described in the present study is a departure from the traditional structure, partnering medical and graduate students for the first year of training and monthly thereafter. The focus of this case study is on faculty involved in undergraduate medical education and graduate biomedical research education; therefore, this section will elaborate on the provision of the UME curriculum, but will not describe graduate medical training, or

continuing medical education.

Medical Education

Flexner's recommendations provided the basic structure of undergraduate medical education (UME) where the first two years of training, or *pre-clerkship*, focus on basic sciences and then in years three and four, or *clerkship*, the focus is on increasing levels of participation in a teaching hospital (Cooke et al., 2010).

Pre-Clerkship Curricular Models. Within UME, several types of curricular models may be employed in the pre-clerkship years (Year 1 and 2). These are: *discipline-based*, *organ system-based* or *integrated medical sciences*, and *problem-based* or *case based learning* models (Cooke et al., 2010).

The medical disciplines model recommended by Flexner was the dominant curriculum until the 1960s. This model included subject courses in anatomy, physiology, pathophysiology, biochemistry, microbiology, histology, and disease management (Cooke et al., 2010). Organ-system or integrated medical curriculum models focus on major body systems, like the cardiovascular system, as viewed from multiple scientific perspectives. Content is primarily transmitted by experts through lecture and requires substantial memorization of facts (Phillips, 2008). While organ-system curriculum models offered a more integrated approach to learning about human anatomical function, there was still gap between the volume of scientific knowledge medical students needed to understand and its eventual clinical application (Cooke et al., 2010).

Problem-based learning (PBL) curriculum models emerged in the 1960s at McMaster University and gained momentum in subsequent decades (Cooke et al., 2010). PBL is a small

group-based instructional method requiring learners to explore a patient case in incremental parts over several classes, while developing a list of facts, hypotheses, learning issues, and additional information needed to accurately make a diagnosis (Barrows, 1996; Barrows & Tabmblyn, 1980; Savery, 2006).

In PBL, students meet several times per week, working progressively through a case, documenting their thinking on a white board and then reflecting on the case and group process at its culmination (Barrows, 1996; Hmelo, 1998; Hmelo-Silver, 2004). PBL promotes students' self-directed learning skills, interpersonal communication and professionalism, and provides tools for approaching patient diagnosis by integrating relevant knowledge within the context of its clinical application (Barrows, 1996; Bligh, 1995; Hmelo-Silver, 2004).

Pre-Clerkship Assessment. As medical students progress through their education, they are required to take a series of multiple-choice question-based examinations (MCQs) and national licensing exams to assess the attainment of the required knowledge and skills (Cooke et al., 2010). At the end of the second pre-clerkship year, medical students take the Step 1, United States Medical Licensing Exam (USMLE 1). The examination is focused on basic science content with particular "emphasis on the principles and mechanisms underlying health, disease, and modes of therapy" (www.usmle.org).

The National Board of Medical Examiners (NBME), established in 1915, administers the standardized set of examinations (www.nbme.org). Three United States Medical Licensing Examinations (USMLE 1-3) developed in the 1980's test basic science knowledge, clinical science knowledge, ambulatory knowledge and the application of this knowledge for patient care (www.nbme.org). These examinations are also referred to as the Step 1, 2, and 3 exams.

Clerkship Curricular Models. In the third and fourth years of medical school, or *clerkship*, students gradually become more immersed in clinical practice. While the emphasis of the program innovation described later in this paper is focused on faculty facilitation in PBL in the pre-clerkship curriculum, a brief description of clerkship models are included to provide a complete overview of the structure of UME.

There are a variety of clerkship curriculum models, *disciplinary-specific*, *longitudinal* and the *mixed-model*, typically organized in into "specialty-specific block rotations ranging from four to twelve weeks" (Cooke et al., 2010, p. 82). Disciplinary-specific clerkships focus on immersing students in the main specialties, surgery, internal medicine, pediatrics, obstetrics, and gynecology. Longitudinal clerkships are progressively developmental, students spend six months to a year with faculty, rather than rotating through each specialty for shorter periods (Cooke et al., 2010).

Finally, a mixed-model includes elements of both the discipline-specific and the longitudinal rotation, where students experience assignments in multiple specialties. These experiences are compressed and then students may be assigned to a single preceptor for the remaining six months of the third year (Cooke et al., 2010).

Clerkship Assessment. The USMLE 2, or Step 2, is focused on knowledge and its application in the clinical sciences. The Step 2 emphasizes "health promotion and disease prevention" and occurs in the fourth year (www.usmle.org). There is a knowledge-based test component, but a clinical skills examination administered through regional testing centers using standardized patients was added in 2004 (USMLE Bulletin, 2012). Standardized patients are specially trained actors that follow specific guidelines in their patient interactions with learners

(K. Szauter, personal communication, June 13, 2012).

The final step in the examination process assesses whether medical trainees can apply knowledge with an "emphasis on patient management in ambulatory settings" and one's readiness for safe, unsupervised patient centered care (USMLE Bulletin, 2012). Step 3 is a two-day examination completed at the end of UME. The NBME and the Federation of State Medical Boards (FSMB) sponsors the USMLE examinations and monitors the results.

Competency-based Medical Education

While not a new concept in education or organizational literature, a relatively recent approach to medical education is a *competency-based*, or an *outcomes-based* approach, focused on results, that is, creating the ideal physician, rather than medical educational structure and processes (Albanese, Mejicano, Anderson, & Gruppen, 2010; Ronald M. Harden, 2007; R. M. Harden, Crosby, & Davis, 1999; Swing, 2010). Competency-based medical education may be defined as "an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It deemphasizes time-based training and promises greater accountability, flexibility, and learner centeredness"; the entire four years of UME may be organized around this type of model (J.R. Frank et al., 2010).

Competency-based medical education begins with the end in mind, and the curriculum is reverse-engineered to support an individual's attainment of the desired end state. Harden, Crosby, and Davis (1999) provide an architectural analogy:

> A key element in the conceptualisation and construction of a building is the architect's plan. This conveys an image in some detail of what the building will be like after it has been completed. The plans provide, for those who are commissioning the building and for the intended users, a clear unequivocal statement as to what they can expect when the building is completed. A judgment can then be made as to whether the final product

> matches what has been proposed and agreed. Building authorities can see whether the building corresponds to the building regulations. Neighbours can see whether the building will intrude on their privacy or space, and negotiations can take place with amendments to the plan where necessary. The plan of the completed building will influence, too, the materials required for use in its construction and the methods of construction adopted. The plan will provide a tool for overseeing progress in the construction of the building. (Harden, Crosby & Davis, 1999, p.7)

Competency-based education deemphasizes curricular structure and process and therefore is a major paradigm shift from Flexner's model of medical education (Jason R. Frank et al., 2010). Outcomes-based education is appealing in that its emphasis is on learner, meeting the recommendations of the most recent Carnegie report calling for increased individualization of training (Cooke et al., 2010). The shift to a competency-based curriculum, however, is not without considerable debate on how to implement, effectively assess, and evaluate learners' competency attainment (Albanese et al., 2010; Ben-David, 1999; Carraccio, Wolfsthal, Englander, Ferentz, & Martin, 2002; Jason R. Frank et al., 2010). Standardization of the educational process is difficult.

Two examples of the competency-based curricular approach in practice include Indiana University School of Medicine and Brown University (Litzelman & Cottingham, 2007; Smith & Dollase, 1999). The process begins with experts identifying domains or categories of important knowledge, skills, and abilities. The educational content, experiences, and assessment are then aligned to support attainment of defined outcomes "requiring simultaneous application of knowledge and ability" by students (Smith & Dollase, 1999, p. 19). Attainment may be measured across levels of mastery, for example, the beginner, intermediate, and advanced levels (Smith & Dollase, 1999). The program innovation that faculty implemented in this case study was derived from competencies in clinical and translational research and will be described later

in the paper.

Current Issues in UME

There was a point in time at which all that was needed to become a physician, one could learn through medical school training (E. Buck, personal communication, October 18, 2012). But as discoveries across all disciplines of science increased, for example, cell biology, virology, genomics, and chemistry; it became increasingly difficult to integrate the growing breadth and depth of scientific knowledge into medical education, especially when we consider diseases like cancer (Rick, personal communication, January 26, 2012). Scientific knowledge complexities and their transfer into clinical application is a persistent challenge for medical education. Other medical education challenges include: inadequate team-based skill development, fostering sound habits of inquiry, and teaching physicians to understand of the full scope of their societal roles (Cooke et al., 2010).

Even in PBL, a collaborative learning model where students work in groups, the emphasis is on individual expertise development rather than teamwork or interprofessional learning (Bleakley, 2006). While PBL is a more active learning method, as compared to lecture-based methods, the specialization and complexity of scientific and biomedical knowledge poses an opportunity to explore new educational innovations in order to further develop team-based competencies. There are opportunities for team-based skills development in clinical research.

Clinical Research. Medical students may engage in summer research programs during the pre-clerkship period or take research electives later during the clerkship years of UME. Medical residents may also engage in research through scholars' programs where residents receive protected time, or time off from clinical duties, to conduct research in their area of

specialization.

Alternately, medical school applicants may enroll in an M.D./Ph.D. program to become a *physician-scientist*. In this program, students begin medical school, and then after their second year, they start a Ph.D. program, returning to complete the clerkship period following their doctoral coursework. Physician-scientists are trained as researchers; however, the average time to M.D./Ph.D. program completion is eight years. This time to completion keeps increasing, an increase of 1.4 years in time to degree since 1980 and this long training time may deter some applicants from enrollment (Brass et al., 2010). A recent study of twenty-four M.D./Ph.D. programs (*n*=5,969 students and alumni) found that 10% withdrew before completing both programs, favoring the medical degree not the research degree (Brass et al., 2010).

While 80% of graduates of dual degree programs report that they were working in academic health centers at the time of the study, the extent to which alumni were contributing to clinical research efforts varied from one quarter time or less (19%), half-time (64%) or three-quarters of their time 39% (Brass et al., 2010). Ninety-five percent of recent M.D./Ph.D. graduates (*n*=939) reported that they intended to continue clinical training versus research. A graduate's decision to pursue research following medical school, a primary objective of M.D./Ph.D. programs, is influenced by residency choice.

For example, of the 939 residents surveyed in 2007-2008, surgery (27%), internal medicine (16%), neurology, (13%) and pathology (8%), residents were more likely to go into clinical or translational research as compared to family medicine (62%), emergency medicine (46%), and dermatology (44%), who predominantly went into private practice (Brass et al., 2010). Unfortunately, it is unclear from the data whether these outcomes are a consequence of

residency choice or that the residency choice results from a decision *not* to pursue a research career preferring private practice (Brass et al., 2010).

Presently, there are a declining number of students pursuing the MD/Ph.D. path. There are several reasons contributing to this decline including: (1) the duration of time to degree, (2) the high attrition rate, and (3) that certain residency fields are more likely to produce private practice physicians, an outcome contrary to the primary goals of M.D./Ph.D. program. Whatever the cause, there is an overall shortage of physician-scientists conducting clinical research (Brass et al., 2010).

Implications for the Study. Understanding the structure of medical education and the reasons for the shortage of clinically-oriented researchers is important to this study because it is the focus of the curriculum faculty are implementing. The alternative program bridges the gap in existing training models that either prepare physicians or scientists to conduct research, and instead, trains them together to work in collaborative teams in the conduct of clinical and translational research. Traditionally, biomedical scientists and future physicians are not trained together. The competency-based curricular innovation described in the present study is a departure from the traditional medical education structure and the clinician scientist training approach. The innovative program faculty implemented, where medical students train alongside basic science graduate students in the pre-clerkship period and longitudinally during clerkship, intends to offer an alternative training curriculum. The innovative program engages graduate students with medical students in an interprofessional (IP) curriculum to promote role understanding, interprofessional communication, and team-based skills in the acquisition of clinical and discipline-specific content knowledge needed to conduct effective clinical and

translational research.

Chapter Summary. A decade ago, Irby and Wilkerson (2003) identified several trends for the future of medical education including: multidisciplinary approaches to science education, the growth of multidisciplinary curricular design and oversight, and integrated curricular structures using active learning methods, technology and learning communities. The case that is described in this study represents the operationalization of these predicted trends. The shift from Flexner's structure and process model of medical education to competency-based models reflects the complexity of the provision of healthcare in the 21st Century and the vast knowledge affecting medical education and scientific research (Cooke et al., 2010; Mann, 2011). The successful implementation of new curricular innovation rests, in part, on the varied expertise of clinical and research faculty working and teaching together in collaborative relationships. Faculty development in such a shifting educational climate becomes significantly important (Dath & Iobst, 2010). The next chapter discusses the role of faculty development in medical education and seminal faculty development literature in higher education.

CHAPTER 3

LITERATURE REVIEW

Faculty Development in Medical Education

Faculty development includes activities that assist faculty in the performance of their academic roles; however there are numerous concepts subsumed within the term faculty development. This chapter will provide background of the primary activities and areas included in faculty development in medical and higher education, such as instructional, organizational, personal and career development. These areas are important since they form the basis of a variety of developmental activities that could be fostered within a faculty community. Understanding faculty development activities also provided background for the way in which results of this study were organized and described. Faculty development differs in higher education and clinical settings although the overall aims of professional improvement are similar. Drawing from medical education literature and seminal studies in higher education, the aim of this chapter is to explain the emergence of faculty development in medical education and to describe the prevalent activities and curricular formats related to it.

As this is a study of a faculty community implementing a new curriculum, the chapter will also review current types of faculty communities defined in the literature and some of their characteristics. The chapter extends the current definitions of faculty community by emphasizing the workplace context for the faculty community studied herein. The chapter concludes with a theoretical framework and chapter summary.

Of the medical education faculty participating in this study, three were basic science researchers with active research programs. One was a practicing pathologist who supervised

students in the preceptorship period of the first year of medical school. All faculty participants taught in both the medical school and the graduate school. As such, they were eligible to enroll or attend the faculty development programs and activities relevant to their faculty roles as mentors, preceptors, and facilitators in the university. Two faculty members had a history of participating in formal faculty development programs, and two did not.

Faculty Development of Clinical Faculty

Historical Perspective

Faculty development in medical education was established more than 50 years ago in order to address a need for developing clinical educators' knowledge and skills for teaching medical students and residents, as deficiencies in teaching and instruction were recognized (Hitchcock & Stritter, 1993; Sheets & Schwenk, 1990; Skeff et al., 1997). George Miller's book, *Educating Medical Teachers* (1980), described the decades following the Flexner Report and some of the early "seeds" of faculty development, as well as the establishment of what is credited as the first faculty development program focused on clinical teaching at The University of Buffalo in 1955 (Miller, 1980, p.5).

From the 1930's to the early 1950's, scientists and clinicians at Northwestern University, University of Minnesota, State University of Iowa, Boston University, and New York Medical College described pedagogical principles for medical education as "just as important to medical teachers as those engaged in nonmedical education" (Reid, as cited in Miller, 1980, p. 15). There is some evidence that medical faculty consulted with education faculty for advice on effective teaching practices even as early as the 1920's; however, these educational efforts failed to take root in a formalized way until 1955 (Miller, 1980).

Several prevailing views in the earlier and mid-century may have hampered the growth of these early faculty development efforts. First, medical school faculty held the view that a medical school's primary responsibility was to train physicians to practice medicine, not teach, since the dominant role of a physician is that of a doctor (Miller, 1980). Second, the field of educational research at the time was perceived by many in medical education as not relevant to adults, but focused on school children and animal experiments (Miller, 1980). Even as the first significant faculty development efforts launched, faculty challenged their utility, substance, and the time commitment required. They felt that the time investment diverted physicians' attention away from clinical research and practice (Miller, 1980).

Two other views prevalent in higher education may have contributed to the challenge of promoting pedagogical practices within medical education. First, some portion of academic faculty held the belief that teaching skills were innate; you were either a good teacher or you were not. Second, some academic faculty believed that an earned doctorate and subject matter expertise inherently meant you were qualified and able to teach. Still others believed that teaching skills were learned from direct observation of teachers during their own educational experiences (Irby, 1994). Research on teaching and pedagogical expertise formation refutes these beliefs, yet these beliefs about teaching persist even today and across the academic spectrum (J. Berliner, 1986; J. Berliner, 2001; Gaff, 1975).

In spite of opposition, "The Buffalo Project" at the University of Buffalo, lead by George Miller and Stephen Abrahamson in 1955, successfully enrolled and trained approximately 70 medical school faculty over three years. The program began as a nine-month program focused on improving instructional practices and attitudes towards teaching and student learning (Miller,

1980). The University of Buffalo faculty development program is credited as the "first sustained effort to teach medical educators about the science of education" (Simpson & Bland, 2002, p. 226). Participants in the Buffalo Project reported a heightened awareness about teaching techniques, appreciation of the contributions of professional educators to medical education, a willingness to explore educational views, increased importance toward defining learning objectives, and increased reciprocal appreciation between basic scientists and clinicians towards each others' roles (Miller, 1980).

Following the Buffalo project, Abrahamson went to Stanford University and then to the University of Southern California (USC) where he started the Division of Research in Medical Education in 1963. The center at USC was one of the first five faculty development centers in United States medical schools (Wilkerson & Anderson, 2004). Other faculty development center sites included the University of Rochester, Michigan State University, Medical College of Virginia, and the University of Illinois at Chicago. (Simpson & Bland, 2002; Wilkerson & Anderson, 2004). The field of faculty development and its programs, methods, and approaches to educating medical school faculty would subsequently enter an age of expansion.

Curricular Models for Faculty Development

Faculty development programs began in family medicine and later expanded to other clinical specialties, universities, and medical schools, which resulted in different curricular models for faculty development. Programs included one to two years of immersion in education with a combination of formal and informal activities, workshops, fellowships, on and off-site and through faculty development institutes (C. J. Bland & Sritter, 1988; Sheets & Schwenk, 1990).

Academic faculty in medicine participated in fellowships, institutes, preceptorships, full-

time non-tenure track faculty positions and full-time tenure track faculty formats with coursework that addressed a range of medical education skills (C. J. Bland, Schmitz, Stritter, Henry, & Aluise, 1990; C. J. Bland & Stritter, 1988). Institutions, such as McGill University in Canada, University of North Carolina, Michigan State, University of California, San Francisco, and the Faculty Development Center at Waco, Texas established regional faculty development centers that emphasized teaching, research, curriculum planning, instructional development, ethics, clinical skills, management, and communications skills (Sheets & Schwenk, 1990).

Two studies examined the effects of these federally funded faculty development programs targeting family medicine faculty. These studies described key characteristics, assessed their impact, and made recommendations for future faculty development needs (C. J. Bland, Dalgaard, Moo-Dodge, & Froberg, 1985; C. J. Bland & Stritter, 1988). Bland and Stritter (1988) found that several formats used in the five federally funded faculty development centers addressed a variety of faculty training needs. These formats were preceptorships focused on short courses, self-study, and limited time away from clinical practice. Non-tenure track formats included yearlong continuous activities, like individual educational projects. Faculty development activities for the non-tenure track positions were held monthly or weekly, not requiring full-time immersion as required by tenure track formats (C. J. Bland & Stritter, 1988). Tenure-track formats generally immersed faculty in an intensive educational program where faculty were involved full-time for one-year, or half-time for two years (C. J. Bland & Stritter, 1988). Two faculty members in the present study (Gus and Agatha) participated in such a longitudinal training program.

While the Bland and Stritter (1988) study is more than twenty years old and identifies

more than thirty attributes of successful programs, the study highlights three important points about structured faculty development programs that relevant to faculty learning within a workplace community. These points are:

1. Successful faculty development programs provide curricular integration.
2. Successful faculty development programs address individual learner needs.
3. Successful faculty development programs consider the longitudinal nature of learning.

First, the authors suggest that curricular activities need to be integrated. Integration refers to both the curricular design and also the use of new skills or knowledge on the job. Curricular integration means that learning activities build on each other in complexity and the topics and activities should be reiterated across the curriculum (Bland & Stritter, 1988). Faculty who participated in an integrated curriculum were more likely to retain new skills, such as a new teaching method, versus programs that were not well integrated.

In the present study of faculty community, faculty skills were developed in response to the practice –based problems that surfaced during the program implementation. The ways in which faculty responded to problems, made decisions, and reflected on their impact, determined what faculty would or would not learn. Thus, learning is fully integrated within the context of faculty work.

Bland and Stritter (1988) also found that faculty development programs offering a variety of courses or experiences (including mentorship and projects) integrated with the faculty work context tended to be more successful in terms of participation and relevance for the individual learner, enhancing overall institutional vitality (C. J. Bland & Stritter, 1988). Conversely, in

workplaces where new skills were not integrated into the daily work of faculty, those skills were quickly "extinguished" (Bland & Stritter, 1988, p. 286).

Last, structured faculty development programs that recognized the longitudinal nature of development and learning by creating a community of learners to support ongoing networking and problem-solving was effective (C. J. Bland & Stritter, 1988). As faculty gain experience and skills, their developmental needs may change. These changes may be in focusing on teaching new subjects, exploring new collaborations, or assuming new leadership responsibilities. It is important for faculty development programs to offer educational opportunities across the career continuum as the professional and career needs of faculty change. Faculty were observed over one academic year. The longitudinal observation provided opportunity to discover evidence about the type and nature of learning of the community and its members over time.

Defining Faculty Development

Identifying a single definition of faculty development is difficult; faculty development broadly encompasses all the activities that assist faculty in the performance of their duties along the career continuum from entry-level faculty orientation and teaching improvement activities, to personal development, organizational development (e.g. continuous institutional learning through shared values and mission), and mid-or late career activities that focus on renewal or faculty vitality (Benor, 2000; C. Bland & Schmitz, 1988 ; Centra, 1978; Irby, 1993; Menges, 1985; Menges et al., 1988; Yvonne Steinert et al., 2006; Wilkerson & Irby, 1998).

Faculty development in higher education has also been described as an organizational "perspective" a higher education institution may take towards the growth and investment in learning of faculty across their careers (S. S. Atkins & M. Svinicki, 1992, p. 26). This view

toward faculty development broadens faculty development from engagement in types of structured activities, to an *institutional perspective* toward faculty growth and the practice of faculty development as "anything that supports that growth, involving the entire professional and personal growth of a professor as teacher, scholar, citizen of the academic community, and person", which is "woven into the fabric of every aspect of faculty life" (S. S. Atkins & M. D. Svinicki, 1992). Faculty development in this view moves beyond the scope of structured workshops and may be embedded or situated in the social practice of academic work (S. S. Atkins & Svinicki, 1992). Opportunities for learning can arise across all facets of faculty work and interactions with colleagues.

Types of Faculty Development Activities in Higher Education

The complexity of defining faculty development is that a variety of similar terminology is used to refer to the activities of faculty development such as: *instructional development*, *educational development*, *professional development* or *career development*, *organizational development*, and *personal development* (Amundsen & Wilson, 2011; Camblin & Steger, 2000; Wilkerson & Irby, 1998).

The broad base of activities that constitute faculty development results in a diverse array of educational services. These may include instructional development, mentoring, assessment, and curricular design support, as well as leadership skills training, organizational development, research skills training (Gaff & Simpson, 1994; McLean, Cilliers, & Van Wyck, 2008; Skeff et al., 1997; Wilkerson & Irby, 1998). As will be discussed in this section, there are challenges to understanding the longitudinal effects of these educational interventions on the faculty who participate.

In a seminal study, Centra (1978) surveyed 756 United States universities and colleges, including 93 graduate colleges and 315 four-year colleges about instructional or faculty development activities. Centra's analysis revealed the most predominant faculty development activities used by universities and colleges at that time. These were: (1) high faculty involvement activities, (2) instructional assistance activities, (3) traditional practices, and (4) assessment related activities.

Centra (1978) described *high faculty involvement activities* as apprenticeships, where experienced faculty members worked with novice faculty in a similar area of expertise or engaged in personal career counseling on a variety of work related areas. *Instructional assistance activities* included educational specialists aiding faculty with the integration of different instructional techniques or classroom strategies. *Traditional practices* included sabbaticals, visiting scholars' programs, grants for summer work projects, and travel grants. *Assessment practices* included support for performance reviews or peer assessment.

Forty-four percent of all institutions surveyed reported a structured department overseeing or organizing faculty development activities (Centra, 1978). Staffing, funding, and structure varied, with less than one fifth of institutions formally evaluating their faculty development programs. Larger universities tended to have more resources and reported the use of specialists working with faculty.

Centra (1978) calculated an index of effectiveness across activity areas based on an average of respondents' ratings. The index ranked the overall reported effectiveness of faculty development practices including: grants and travel funds, instructional assistance, assessment support, and traditional practices (workshops) as reported by the universities. Interestingly, the

workshops and seminars category received the lowest rating; yet, even today it is a predominant approach to faculty development (Steinert, 2010).

The study included "extent of use" across the activities (Centra, 1978, p. 161). Sabbaticals and teaching load reduction, faculty-to-faculty activities like mentorship, and assessment support were used across institutions. Larger universities used sabbaticals or reduced teaching loads and smaller universities used faculty-to-faculty activities to foster faculty development. Centra's study concluded that instructional development activities were a prominent feature of faculty development programs.

Centra's (1978) seminal study is important to consider in this study. It contributes evidence that high faculty involvement activities, where faculty aid one another in instructional or career development, have existed as a source of faculty learning and development for decades. Unfortunately, as will be described in several literature reviews of faculty development that succeeded Centra's study, examinations of faculty learning and development through less structured, qualitative means has been largely absent. This gap may likely be a result of the emphasis on instructional development and the dominant positivist research paradigms of the time. The next sections provide some elaboration on the activities subsumed within faculty development.

Instructional Development. *Instructional development* may include supporting the advancement of faculty skills in course or curriculum development, the acquisition or enhancement of presentation or facilitation skills, using classroom technology, or learning a particular teaching method, such as problem-based learning (Amundsen & Wilson, 2012; Camblin & Steger, 2000; Centra, 1978; Irby, 1996; Wilkerson & Irby, 1998).

Similar to Centra's (1978) seminal study, Berquist & Phillips posited that the instructional dimension was dominant in faculty development activities. Berquist and Phillips' (1975) described a three-dimensional model of faculty development that included organizational, instructional and personal dimensions, which they developed through both experience with faculty programs and case examples. The instructional dimension of the model included classroom management and microteaching, as well as educational methodology and technology (Berquist & Phillips, 1975).

In medical education in particular, a preponderance of research on faculty development focused on instructional and pedagogical effectiveness (Yvonne Steinert et al., 2006). The emphasis on instructional development in the literature is understandable since faculty roles are comprised of teaching responsibilities.

Career or Professional Development. *Career development* emphasizes preparation for faculty career advancement across the academic career trajectory (Menges, 1985). *Professional development* activities emphasize the growth and development of faculty, through disciplinary-focused conferences, receiving time off for research or to pursue an advanced degree to keep current with their field (Gaff & Simpson, 1994).

Professional development could include leadership training needed to function effectively in an academic leadership role although Irby and Wilkerson have described leadership as its own category for development (See Irby, 1996; Wilkerson & Irby, 1998). Department chairs may be experienced faculty but inexperienced administrators. National training opportunities through institutes or workshops in leadership development may be a source for professional development (Raines & Squires Alberg, 2003). For example, the American Association of Medical Colleges

(AAMC) offers professional development workshops in advance of the annual medical education conference and topics change from year to year (AAMC, 2012).

Professional development could include self-directed learning experiences or formal program attendance over the course of one's career but influenced by numerous factors such as personal interests, life events, intellectual characteristics, commitment to continuous learning, desire for change, or in response to career burnout (Caffarella & Zinn, 1999).

Personal Development. *Personal development*, which emphasizes life planning, interpersonal skills, and the growth of faculty as individuals may also be the focus of and a natural by-product of professional faculty development efforts, contributing to faculty renewal and vitality (C. Bland & Bergquist, 1997; C. Bland & Schmitz, 1988; Irby, 1993). In Berquist and Phillips (1975) model, the personal development dimension focuses on interpersonal skills, personal growth workshops and supportive or therapeutic counseling. Personal development may come through the camaraderie and peer interaction reported by faculty who engage in faculty development activities. These interactions may contribute to other research collaborations or ongoing personal relationships (Camblin & Steger, 2000).

Organizational Development. *Organizational development* emphasizes the strategies, needs, and priorities of the institutions in which faculty work and through the increased effectiveness of individuals, groups or teams, faculty can contribute to organizational change more broadly (Camblin & Steger, 2000; Gaff, 1975; Wilkerson & Irby, 1998). Faculty are influenced by the colleagues with whom they work, the departments to which they belong, the cultural norms of the university, the body of disciplinary knowledge, and the policies that govern the university (Gaff, 1975). Organizational development is at the top of the hierarchy in terms of

the role of faculty development to impact change in instruction, curriculum, or the entire educational institution.

In Berquist and Phillips' (1975) model, the organizational or departmental level dimension includes training in conflict management, decision-making, team-building and management development; however, the authors assert that these interventions affect organizational change contingent upon satisfying assumptions underlying the other dimensions. For example, the *process* of adopting new instructional methods is contingent upon faculty *attitudes* that align with what the faculty member values as important, and that the activity works within an organizational *structure* that rewards the new knowledge, or removes barriers to its implementation (Berquist & Phillips, 1975).

In an institutional study of strategies used in faculty development for enhancing academic vitality and faculty renewal, researchers recommended that aligning the individual's value of activities, with institutional rewards and institutional goals, or matching personal and organizational goals to achieve the maximum benefit (C. Bland & Schmitz, 1988). The field of human resources development (HRD) has been concerned with individual work and organizational goal alignment and its tie to human performance and effectiveness for decades. Interest in this alignment within the academy should be the same if not greater (although of a different type), since the value of human capital and burden of non-productivity and ineffective personnel is a greater institutional drain (C. Bland & Schmitz, 1988).

More recently, a University of Cincinnati study surveyed faculty to understand if a faculty development program organized around institutes and competitive proposals for faculty members' developmental needs and goals (individuals, groups, and departments), influenced the

institution. Ninety percent of those participants who were successfully funded and responded to the survey (*n*=177) reported that after they engaged in the faculty development activity, institute, or project, they shared their experience or new knowledge with colleagues. Forty-seven percent of faculty who responded to the survey, but *did not* get funded to participate in a faculty development program reported indirect benefits derived from a colleague's participation.

Participants who were successfully funded reported that their participation enhanced pedagogical skills, changes to aspects of teaching, and implementation of course or curriculum changes (Camblin & Steger, 2000). Faculty and administrators believe that colleagues teaching and communicating what they are learning suggests that if faculty development is aligned with the University's strategic vision, it may change the way the University functions because of the far reaching effects of participation (Camblin & Steger, 2000).

Professional development, instructional development, leadership and *organizational development activities* can guide the strategic organization of a faculty development program in medical education (Wilkerson & Irby, 1998). These developmental areas apply to individuals dependent upon their level within the institution (e.g. new assistant professor versus department chair), and address how faulty developmental needs may change over time. For example, professional development activities orient new faculty to their roles, including a basic introduction to the values and norms of the institution and expectations for scholarship, teaching, and promotion. Instructional development may focus on initial teaching skills, for example, introducing a faculty member to problem-based learning approaches, or how to teach in an ambulatory setting (Wilkerson & Irby, 1998).

With time and experience, faculty may wish to advance their knowledge and scholarship

about teaching. Leadership development targets individuals who are in faculty roles where they are influencing other faculty and championing change within the institution. For example, faculty development in this area would focus on skills for "curricular change, including the ability to articulate a captivating vision and promoting shared values and using the tools of quality improvement, including multidisciplinary teams, and consensus building strategies" (Wilkerson & Irby, 1998, p. 393).

What We Know From Faculty Development Research

Reviews of faculty development research aimed at measuring changes following interventions have revealed inconsistent outcomes, especially for teaching enhancement (Amundsen & Wilson, 2012; K. J. Gillespie, Robertson, & Associates, 2010; Groccia & Cruz, 2013; Levinson-Rose & Menges, 1981; Yvonne Steinert et al., 2006). Three reviews of the literature will be discussed: Levinson-Rose and Menges' (1981) study on college teaching and instructional improvement, Steinert's (2006) review of teaching enhancement in health professions, and a more recent review by Amundsen and Wilson (2012). These reviews provide a relevant overview of the state of faculty development research. At the conclusion of the chapter, Table 3.1 provides a compilation of the seminal studies of faculty development.

Levinson-Rose and Menges' (1981) critical review of research on college teaching indicated that research from the prior 15 years failed to demonstrate consistent and reliable results of interventions aimed at instructional improvement. The study included multiple intervention studies (n=71) aimed at teacher behavior change (through self-report), knowledge change (through observer assessment or self-report), skills improvement (observer assessment), changes in students' attitude (through student self-report), or student learning (assessed through

observer or testing). Workshops and seminars failed to demonstrate behavior change effects because of poor research design such as lack of randomization, no controls, low statistical power in experiments, or lack of evaluation altogether (Levinson-Rose & Menges, 1981).

The authors concluded that because many of the studies focused on graduate-level teaching assistants, there were also gaps in understanding the instructional development needs of experienced faculty at different career stages. They recommended that future research consider alternative designs, particularly those where experiences of students and teachers are described in ethnographies, case studies, and clinical interviewing techniques (Levinson-Rose & Menges, 1981).

In a systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education, Steinert and colleagues (2006) identified 53 papers across five typical types of faculty development activities between 1980-2002: workshops, short courses, seminar series, longitudinal programs, and fellowships. The studies employed a variety of instructional methods, with 62% being a workshop or seminar series format. Few studies were linked to teachers' ongoing educational practice. Methodologically, none of the studies exclusively used a qualitative research method but rather incorporated qualitative data with quantitative methods.

The authors used Kirkpatrick's Four-Level Evaluation Model (1994) to categorize the outcomes of the studies in the review. The four levels of educational outcomes included: *reaction* to the educational intervention, *learning* new knowledge or skills, *behavior* change (e.g. implementation of what was learned), and *results* level (e.g. organizational effects of learning; Steinert, et al., 2006).

Key findings of the review were that across Kirkpatrick's levels, 19 studies assessed self reported changes in attitudes (e.g., motivation, enthusiasm), 31 studies reported changes in knowledge or skills of participating faculty (e.g., questioning skills, student participation), 13 studies assessed self-reported changes in faculty behavior (e.g., teaching abilities), 25 also assessed observed changes in behavior (e.g., student evaluations of teaching). Finally, 10 studies assessed changes to organizational practice or in students (e.g., dissemination of skills institutionally and examination scores). Forty-five of the studies collected data across more than one level of outcome, which is why changes were reported for 98 studies. For the studies included in the review, several methodological weaknesses were identified: limited study designs (e.g., predominantly single group, pre-post test), low response rates, inconsistent use of intervention terminology, insufficient background detail on the intervention, and a need to assess impact over time (Steinert, et al., 2006).

Another recent conceptual review of the literature identified *practice clusters* in faculty or educational development research (Amundsen & Wilson, 2012). The authors reviewed 137 articles from literature in higher education as well as medical education, to understand how faculty or educational developmental practices were designed and the conceptual thinking underpinning their practice. The articles included in the review were published between 1995 and 2008. They were organized based on a purpose, characteristics, and literature cited. The authors categorized the existing research into one of six clusters: *skills*, *method*, *reflection*, *institution*, *disciplinary*, or *action research* (Amundsen & Wilson, 2012).

The skills cluster (n=14) included studies that examined specific and observable techniques related to teaching, for example, facilitation of class discussion. The methods cluster

(*n*=33) centered on use of a particular teaching method and its adoption. The reflection cluster (*n*=30) included studies that examined the growth or change in teacher's conceptions of teaching through reflective practice. The institutional cluster (*n*=37) examined organizational level or strategic initiatives at a university to support teaching improvement of university faculty more broadly.

Disciplinary research studies (*n*=4) focused on the role of disciplinary knowledge as a basis for the development of pedagogical knowledge. For example, activities in disciplinary research studies included the effects of scholarly discussion among colleagues (e.g., an article in science education). The last cluster identified by the authors included action research studies (*n*=19). Action or inquiry research referred to studies where the faculty identified an area in need of development, for example, integrating technology into teaching, and with the support of colleagues' feedback, observation and collaborative discussions, self-selected to examine and develop that area of their practice.

Because this study is about how a faculty community used reflection to advance their understanding of a curricular implementation, it is important to highlight the outcomes from the reflection research cluster. These thirty studies focused on the role of reflection in faculty development for:

1. Change in individual teacher's conceptions of teaching and learning
2. Reflections for conceptual change leading to changes in teaching practice
3. Activities to prompt and support individual reflection
4. Including a collegial element to aid individual reflection
5. Assessment of intervention impact based on individual change in conceptions about teaching and learning (Amundsen & Wilson, 2012, p. 98)

Aligned with this prior research, I anticipated that the outcomes of participation in faculty community could include one or more of these five outcomes.

In a cross-cluster analysis, Amundsen and Wilson (2012) further distinguished a study's orientation as either *process* or *outcome oriented*. Studies in reflection, disciplinary, or action research clusters highlighted the *process* of educational development. Engagement in reflection, disciplinary discussion and inquiry lead to changed thinking about faculty teaching and roles. Process orientated studies resulted in "different outcomes for different faculty or multiple outcomes for an individual faculty member" (Amundsen & Wilson, 2012, p. 108). Further, when considering outcome versus process, the researchers used three contrasts to compare the studies' educational orientation. Centralized or decentralized institutional position, focused on content or on ongoing professional development, and teaching as an individual or socially situated practice.

The present study of faculty community may be classified as a process-oriented study that sought to understand how reflection, discussion, *and* inquiry of faculty working on a program implementation contributed (or failed to contribute) to their learning and development. Work related activities were the basis for reflection and faculty discussion. This study examined the emergence of faculty development that is decentralized (e.g., not led by an educational faculty member) and addressed ongoing development rather than development of a discreet skill or topic through a focused intervention.

The challenges of understanding faculty development over time, the instability of previous results, and the dearth of studies examining the learning trajectories of experienced faculty in communities supported the methodological approach used in this ethnographic study of faculty community.

Barriers to Faculty Development Participation

As previously discussed in reviews of the literature, the paucity of research on the long-term benefits of faculty development is in of itself a barrier to faculty development participation (McLean et al., 2008). A lack of evidence on its effectiveness may dissuade academic faculty to participate. A second, and I would argue significant, barrier to participation in faculty development programs is that faculty may not believe they need teaching improvement. Clinical faculty who are knowledgeable in their discipline feel they are qualified to teach it (Irby, 1994). As discussed in the medical education chapter, this belief permeates not only medical education but also other areas of academia. Unfortunately, this belief excludes consideration of the myriad of interacting factors that influence learning outcomes, such as individual characteristics of learners, prior knowledge, instructional methods, or students' motivational orientations and epistemological beliefs.

Finally, institutional culture is a barrier to faculty development participation. Making the time to participate in faculty development activities may be a low priority, if there is no perceived incentive for participation. If institutions fail to connect continuing faculty development and teaching improvement to the promotion, tenure, and reward structure, there is little or no incentive for participation. In fields like medicine and biomedical science, where research and clinic time is prized, alignment with performance metrics and reward structures is critical to overcoming this barrier (McLean, et al., 2008). Even then, there is no guarantee for participation.

In this study, two members of the community participated in university-led faculty development activities. The other two members did not express an interest in or devote time to faculty development activities. This mix of interest and prior participation within the community

may be influential in overcoming these barriers for those who have not expressed value or interest in participation in faculty development activities previously. Finally, examining a faculty community learning through work in a community may provide insight at ways to overcome of the barriers to faculty development participation.

A Community Framework for Faculty Development in Medical Education

Faculty development perspectives in medical education typically promote a causal or linear effect of faculty development activities on student and faculty quality outcomes (O'Sullivan & Irby, 2011). For example, a faculty member attends training, he or she learns a new instructional method, returns to the classroom or the patient bedside, applies that new instructional method, and student learning is enhanced. There is little evidence to suggest how the facets of the workplace, such as colleagues, supervisors, and institutional policies or culture toward teaching support or influence faculty development in an academic health center.

Existing models and approaches to faculty development fail to account for "the power of communities for supporting and strengthening instruction in the workplace" (O'Sullivan & Irby, 2011, p. 425). O'Sullivan and Irby (2011) proposed reframing inquiry into the nature of faculty development in medical education. In O'Sullivan and Irby's (2011) model, faculty development is construed as a complex social enterprise. The proposed model depicts faculty development as embedded within two workplace communities of practice. These two communities are the *faculty development community of practice* and the *clinical or classroom workplace community of practice* (O'Sullivan & Irby, 2011).

A *faculty development community of practice* refers to the collective participants of workshops, seminars, and teaching academies as part of a formalized faculty development

program. Elements of the faculty development community include the facilitator, participants, context of the program, and staff who work with faculty beyond the classroom. The *clinical or classroom workplace community of practice* includes tasks and activities, relationships and networks, and the organizational systems and culture within which a faculty development community is subsumed. The features of the clinical or classroom workplace community of practice influence faculty control, autonomy, and personal interest in one's work activities, constraining or enhancing faculty development (Steinert, 2010).

In the new model of faculty development, the authors recommend future research in faculty development explore several areas: the role of these communities in workplace teaching practice, influences of community relationships on faculty learning outcomes, and how participants engage their colleagues after participating in formal faculty development programs or courses (O'Sullivan & Irby, 2011). Last, the new model suggests that future research examine the developmental trajectory of participants.

This study sought to address the current gap in faculty development research by exploring these influences of community in faculty development. Prior to describing the methods that were used in this study of a faculty community, a review of relevant literature on faculty communities is offered. The review is important in order to distinguish the types of faculty communities previously studied by faculty development researchers and the type of faculty community studied in this present research.

Table 3.1.

Summary of Important Faculty Development Literature in Higher and Medical Education from 1975-Present.*

Author(s)	Publication Type	Focus	Findings or Recommendations for Faculty Development
Gaff, 1975	Book	Faculty, instructional, and organizational development of Higher Education.	Defined and characterized faculty, instructional, and organizational development.
Berquist & Phillips, 1975	Conceptual Article	Proposes 3-dimensional model for faculty development in Higher Education.	Three interrelated dimensions for faculty change: Organizational (structure), instructional (process), personal (attitudinal).
Centra, 1978	Research Article	National survey of 756 institutions on predominant instructional, faculty development activities.	Predominant activities included: 1) high faculty involvement, (2) instructional assistance, (3) traditional practices, and (4) assessment.
Miller, 1980	Book	Historical review of early faculty development in Medical Education; Buffalo Project.	First sustained effort to teach the science of education to medical educators.
Levinson-Rose & Menges, 1981	Review Article	Period of 1963-1978, 71-article analysis on instructional intervention effectiveness.	Difficulty parsing factors in effective faculty development interventions.
Stritter, 1983	Review Article	Extended Centra's study in technical assistance, high-faculty involvement, and assessment.	Weakness in faculty development research due to simplification of analytic methods; Suggested qualitative strategies.
Bland & Schmitz, 1986	Review Article	Research support in faculty development.	Recommended structure for a faculty development program focused on research skills.
Menges, 1985	Conceptual Article	Broadens conceptions in determining faculty development program design to include impact of life stage factors and events.	Faculty development assists faculty in 3 career transitions: remain in higher education, retain faculty appointment, and remain in the same field.
Bland & Schmitz, 1988	Review Article	Faculty vitality review; catalogued existing and proposed strategies to develop faculty, departments, and institutions.	Efforts target individual, organization or departments; workshops, sabbaticals and leaves, faculty evaluation, professional development plans. Link between faculty development and organizational mission and personnel

	policies; design program to faculty needs.

Table 3.1. Cont.

Author(s)	Publication Type	Focus	Findings or Recommendations
Bland & Stritter, 1988	Research Article	Critical elements of effective 5 federally funded faculty development programs.	30 characteristics; organized under 6 main categories: mission, personnel, curriculum, participants, internal relations and external relations.
Sheets & Schwenk, 1990	Review Article	Effects of family medicine faculty development efforts.	Established recommendations on fellowship structure.
Wilkerson & Irby, 1998	Conceptual Article	Propose a four-category model for faculty development.	Links the model to learning theories and contemporary views of faculty development.
Bland, Schmitz, Stritter, Henry, & Aluise, 1990	Book	Curricular models for faculty development programs across domains of education, research, writing, professionalism, and administration.	Guide for developing faculty development curriculum in Medical Education.
Steinert, 2006	Review Article	Effects of faculty development interventions on knowledge, skills, or attitudes of participating medical teachers.	Focus on interventions; inconclusive outcomes of the benefits of workshops/interventions to enhance teaching.
Amundsen & Wilson, 2011	Review Article	Review of the literature	Clusters research in six foci: skills, method, reflection, institution, disciplinary, or action research.
Gillespie, Robertson, & Associates, 2010	Book	A Guide to Faculty Development	State of the field, resource for getting started in the educational development profession.
Groccia & Cruz, 2013	Book	Annual Professional Organizational Development (POD) publication, comprehensive guide.	State of the field, resource for improvement in higher education

* Adapted and updated from McLean, et al., 2008 and Hitchcock, Stritter, and Bland, 1993.

Faculty Development through Faculty Community

The concept of learning communities is not a new one. The philosophical origins of faculty learning communities may be tied to Deweyian ideals of education as a social process, informed by the interaction between teachers' experience in the classroom, inquiry into the problems of practice and then reflection on those experiences (Cox, 2004; Dewey, 1910; Lenning & Ebbers, 1999; Stoll et al., 2006). A faculty community is a type of learning community where faculty learning is the focus (Lenning & Ebbers, 1999).

Faculty Learning Communities. Since the 1970's, *faculty learning communities* (FLCs) in higher education have been the focus of research by Milton Cox and colleagues at The Miami University of Ohio (Cox, 1999, 2004, 2012; Hubball & Albon, 2007; Hubball, Clarke, & Beach, 2004; L. Richlin & Cox, 2004; Laurie Richlin & Essington, 2004). Cox defined a faculty learning community as a "cross-disciplinary faculty and staff group of six to fifteen members (usually 8-12 members) who engage in an active, collaborative year-long program with a curriculum about enhancing teaching and learning and with frequent seminars and activities that provide learning, development, the scholarship of teaching, and community building" (Cox, 2004, p. 8; 2012).

Faculty communities may be either *cohort-based* or *topic-based* (Cox, 1999, 2004; Laurie Richlin & Essington, 2004). A *cohort-based* FLC may include groups of junior or early career faculty, department chairs, or graduate students preparing for future faculty (PFF) positions (Cox, 2004). A cohort-based FLC is for similar level peers to address shared job related learning interests. The PFF-FLC differs from the other cohort

based-models in that students who are preparing to become future faculty members are also teaching at the school where they are studying (L. Richlin, 2006).

In a *topic-based* FLC, the topic is determined by a shared interest arising from teaching, such as using technology in the classroom (Ward & Selvester, 2012) or facilitating problem-based learning (Cox, 2004). Similar to faculty development programs in medicine, participants in FLCs may develop an individual educational project over time (Cox, 2012). Learning from colleagues is ranked very favorably in studies that have examined the views of participants in FLCs.

Unlike the faculty community described in this study, cohort and topic-based FLC have a pre-defined agenda that provides a structure for faculty work. A faculty development director offers ongoing guidance through workshops or seminars, primarily focused on teaching (Cox, 2004, 2012; L. Richlin & Cox, 2004). For example, a book on teaching may direct the topics of the first few faculty meetings, and subsequent group discussions may revolve around those initial meetings (Blaisdell & Cox, 2004). Faculty learning is the focus, but it is a group that is still conducting its educational activities separated from the context of day-to-day work.

Professional Learning Communities. Stoll and colleagues' (2006) article distinguished professional learning communities (PLCs) from faculty learning communities (FLCs). In PLCs, the emphasis is on the *professionalism* aspect of the community. The professionalism designation indicates the community is concerned with the acquisition of a set of skills or knowledge, for example, training new educators on appropriate interactions with students and colleagues (Stoll et al., 2006). Although

professionalism is not the only focus, the goal of learning in a PLC is to promote professional behavior. Membership in a PLC depends on the school, and may include administration, teachers, the entire school, and students (Stoll et al., 2006).

A PLC is often used within K-12 education. The nature of higher education teaching, and professional education in particular, differs from the K-12 environment in several ways. First, college and university faculty are focused on professional and career-related training that is discipline-specific, so the roles and responsibilities of its faculty vary (Menges & Austin, 2001). Second, higher education students are of varying age, prior experience, and adult developmental stage (Menges & Austin, 2001). While professionalism is one aspect concerning faculty workplace activities in the graduate education of biomedical scientists and undergraduate medical students, it is not the focal point.

FLCs and PLCs share common characteristics that are indicative of effective learning communities. These characteristics are mutual support between members, shared values and vision in the group, collective responsibility, engaging in reflective inquiry, and collaboration that simultaneously promotes group and individual learning (Cox, 2004; Stoll et al., 2006).

Faculty Thinking Communities. What are the benefits to faculty in communities who form through their own intention and self-direction? A *faculty thinking community* (FTC) is comprised of faculty who self-select to work with a group of peers and is not restricted by a structured program or focused primarily on teaching professionalism (Eddy and Garza-Mitchell, 2011). Faculty thinking communities are groups of faculty

that may branch out from a structured FLC. FTCs emphasize reflection on members' underlying assumptions about their academic roles and aim to nurture knowledge creation and creativity beyond the program in which the community initially formed (Eddy & Garza Mitchell, 2011).

The emphasis of a faculty thinking community is on *process*, not the creation of a scholarly *product* per se. Reflective practice is a focal point of the interaction; it is a continuously interacting group that is not defined by an end point (Eddy & Garza Mitchell, 2011). The emphasis is not focused solely on teaching or instructional development and can include any topic related to the work of the community. Regular meetings, shared research interests, reflection, and group synergy form the basis for faculty learning (Eddy & Garza Mitchell, 2011). Reflection in the faculty thinking community is described as a central function of the group.

The Role of Communities in Faculty Learning

An examination of faculty communities reveals numerous benefits for the faculty who are engaged in them, especially for mid-career and senior faculty. The value of community for faculty includes: enjoyment of work, increased scholarship, reduced professional isolation, curricular integration, collegiality, disciplinary creativity, and enhanced satisfaction with their students learning (Blaisdell & Cox, 2004; Lenning & Ebbers, 1999).

Early Career Faculty. For early career or junior faculty, faculty communities reduce the isolation and stress associated with beginning college teaching and increase the scholarly knowledge of teaching and learning, especially with repeated participation

(Cox, 1999; L. Richlin & Cox, 2004). For faculty who participated in two faculty community experiences at the Miami University of Ohio, 53% produced a peer-reviewed paper or presentation on teaching (L. Richlin & Cox, 2004). For those engaged in four or more FLCs, approximately 83% produced a peer-reviewed educational paper or presentation. Cox (1999) also reported that faculty from FLCs tenured at a faster rate than the university average.

Value for Mid to Senior Career Faculty. Blaisdell and Cox (2004) explored the effects of faculty learning communities on senior and mid career faculty at two universities. Faculty participants reported that learning from peers in faculty learning communities was valued most (Cox, 1999). Colleagueship and learning from other participants ranked as the two most impactful effects of participation.

Lincoln (2000) describes a "simple insight" about the nature of community for experienced faculty members:

> ".. not all of our colleagues are themselves learners in a learning community. Community itself is defined by mutuality and reciprocity. But mutuality and reciprocity are undermined- and unequal relations created- when students are expected to learn from those who are they themselves no longer learning…. Perhaps one responsibility that goes with 'community' is the commitment to work with those colleagues who seem to have lost their zest for learning, their excitement for an intellectual adventure of their own making. In the eager pursuit of our own intellectual satisfactions, we might have lost sight of the developmental needs of others who may not share our energy or psychological makeup, or who may have gotten sidetracked or otherwise derailed from the spirit of shared inquiry. (Lincoln, 2000, p. 248).

This quote highlights that midcareer and more senior faculty in a community can support colleagues in the experience of continuous learning, faculty can take their work in new directions with new or different colleagues as collaborators (Blaisdell & Cox,

2004; Roberts, 2012). In medical education, the effect of faculty development activities on mid-career and senior faculty members is also referred to as *faculty renewal* or *vitality* (C. Bland & Bergquist, 1997; C. Bland & Schmitz, 1988; Irby, 1993; Woods, Reid, Arndt, Curtis, & Stritter, 1997). Experienced faculty may find membership in a faculty community enjoyable because of the relatedness or colleagueship they feel to other participants and because it is a potential antidote for faculty burnout (Blaisdell & Cox, 2004).

Faculty Practice Communities

The previous sections provide various definitions of faculty communities where individuals participated in collaborative inquiry and problem solving around a work-based issue, instructional challenge, or goal of mutual interest to its participants. Faculty communities may start within formalized faculty development programs but may continue after the structured program ends. Faculty communities vary in size, work goals, domain area, membership, and longevity. Characteristics of the faculty community generally include mutual respect, regular communication, and a commitment to improvement. Faculty communities can form through the self-selection of membership independent of any formalized entity or institute, in order to make educational improvements. Professionalism and teaching may be one facet of learning in a faculty community, but not necessarily the only focus of learning.

The current review of the literature did not provide a precise definition of faculty communities that applied to the existing study. I argue that existing definitions of faculty learning communities, professional learning communities, and faculty thinking

communities as defined by other scholars, fail to capture the complete scope and complexity of what is learned through a reflective faculty community embedded within the workplace. Eddy and Garza-Mitchell's (2011) definition of a faculty thinking community provides a closer description of faculty communities that form and sustain through less-structured or guided means, with an emphasis on reflection and learning through reflection. However, for the faculty community in this study, its value and its functions are determined not only by its membership and goals, both collectively and individually, but across the range of challenges situated in and arising from faculty work responsibilities.

The community examined in this case study is *practice-centered*, a community of practitioners that is studied within a workplace context. A practice-centered community is concurrently a learning, thinking, and professional community. Practice may include teaching, administration, assessment, negotiating organizational politics, research, grant writing, student learning and mentoring. Faculty learning is unstructured, evolving longitudinally through continuous social interaction. The shared duties of the community require dialogue and reflection. The concept of *practice* accounts for faculty learning as distributed across a social system rooted in the problems arising from engagement in academic work.

Practice also refers to learning in progress. Deliberate practice (and maintenance) of any skill, be it chess, piano, or swimming, contributes to the development of expert performances (Krampe & Ericsson, 1996). Regardless of one's expertise within a domain, outside that domain of knowledge or skill, individuals are unable to perform at

the same expert level (Ericsson, Krampe, & Tesch-Romer, 1993; Glaser, 1985). The variety of responsibilities required of a faculty position necessarily presents a broad range of situations in which faculty may find themselves performing at a novice level, despite their beliefs about their own competence. For example, expertise in cancer research does not necessarily translate to strong leadership or the skills to teach cancer mechanisms to a new graduate student.

Last, from the perspective of the faculty who engage in these communities, using the term *faculty practice community* may also reflect the inclusive and comprehensive nature of learning with and through peers at work. *A faculty practice community* is more specifically defined through the *intention of its members* in seeking out peers with whom they might want to learn from through a diversity of practice experiences. The FPC has the potential to be a forum for authentic, reflective learning and faculty development.

It is important to note that while I am focused on the faculty community as the central phenomenon of interest, it is not to the exclusion of students or the higher education organization, which constitute the full context for faculty learning. Student learning and faculty learning are inexorably linked (Ramsden, 1992).

Learning in Faculty Practice Communities: Theoretical Framework

As indicated, faculty workplace communities are embedded in a social, political, institutional system that facilitates (or constrains) learning and that system has the potential to contribute to how faculty practitioners learn. Adult theories of learning tend to be the default theory within faculty development literature. It is important to consider the role of social context in models of learning to explain how adults learn in certain

settings (Cobb & Bowers, 1999; Derry, DuRussel, & O'Donnell, 1998; Lave, 1991, 1993; O'Donnell, 2006).

Two socioconstructivist learning perspectives informed the current study: *communities of practice* (Lave, 1993; Lave & Wenger, 1991) and *distributed cognition* (Resnick, 1991; Salomon, 1993; Wertsch, 1991). Both community of practice theory and distributed cognition are not discreet theories, but rather each is described along a continuum that holds individual cognition as either absent or a component of analysis in learning (Moore & Rocklin, 1998). The next section describes these theoretical views in more detail. Distributed cognition and community of practice theory, may offer broader explanatory support for faculty development in faculty community. These theories account for the interaction of social, political, and institutional factors in individual cognition.

Socioconstructivist Theories of Learning

Socioconstructivist views of learning posit that individual learning is constituted by the environment or social settings in which individuals participate (Vygotsky, 1978). Characteristics of learning through participation are *social negotiation* and *scaffolding*. When individuals with different disciplinary expertise work together, different "cognitive histories" create multiple interpretations of work-related problems and their solutions (Derry, DuRussel, & O'Donnell, 1998, p. 27). *Social negotiation* refers to the process whereby participants discuss individual understandings of an issue with the aim of developing a mutual understanding or shared representation of that issue (Derry,

DuRussel, & O'Donnell, 1998). Social negotiation is used to synchronize the activities of a group.

In the present study, for example, each faculty member came to the community with a different orientation to instructional methods and no experience in competency-based curricular models. One faculty member used lecturing and was unfamiliar with active learning methods. Each faculty member was an expert in different scientific areas, like virology or cancer. Two faculty belonged to different departments in the institution, two reported to the same department chair. Each attended different universities and, while experienced in their respective fields, each taught different courses in the graduate and medical school. Each faculty member brought these varied backgrounds to the activities of the community.

A second feature of sociocultural learning theory is *scaffolding* (Vygotsky, 1978; Wood, Bruner, & Ross, 1976). The term scaffolding refers to a support, in this case a cognitive support, that is slowly removed as a one becomes more competent at a task (Wood et al., 1976). Theorists refer to the distance between the actual developmental level of an individual and the potential developmental level achieved through scaffolding as the *zone of proximal development.* The *zone of proximal development* is the "distance between one's actual developmental level as determined by independent problem-solving and the higher level of potential development when problem-solving under guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86 and as cited in Wertsch, 1991, p. 28).

While scaffolding is used to describe interactions that occur between novices and

an experienced, or a more knowledgeable other working together on a task, scaffolding also occurs between similar level peers who may be experts in different areas. Through scaffolding, novices can attain a higher level of performance than they might otherwise through working alone. Membership in a faculty community affords access to and occasions for peer guidance that may not otherwise be available to those outside of the community (Billet, 2002). Research demonstrates that the interactional patterns of scaffolding are not purely determined by the more knowledgeable person, but that the learner determines what is learned as a result of features of the interactions, such as questioning, and the learner's willingness to make changes in the future (Ko, Schallert, & Walters, 2003).

An example of scaffolding that applies to this study is the scenario of a faculty member who is accustomed to lecturing who then works with two other faculty members who use problem-based learning in teaching. The lecture-based instructor does not know the steps and methods used for problem-based learning in the classroom, even though the faculty member can understand the concept of using problems as a basis for learning. Classroom observation of a colleague's problem-based learning class, and discussions and explanations between the two faculty peers can build a common understanding of the method in use. It scaffolds the lecture-based instructor in the use and application of the method. The novice faculty member would determine if he feels knowledgeable enough, confident about, or ready to implement the problem-based learning method in his own classroom.

Communities of Practice

Faculty Development and Community. Community of practice theory offers a way to understand faculty development in a faculty community (Blanton & Stylianou, 2009). The theory emphasizes the "relational interdependency" of learners and their social worlds (Lave, 1991, p. 67). A *community of practice* is an "activity system about which participants share understanding about what they do and its meaning" (Lave & Wenger, 1991, p. 98). Within a community of practice participants gain expertise through the process of *legitimate peripheral participation* (LPP). LPP is a process where newcomers are acculturated into the community, its ways of acting and performing, of knowledge and skill; and a way to explain "the relationships between newcomers and old timers" (Lave & Wenger, 1991, p. 29).

Faculty learning in a community of practice is *situated*. Situated learning does not refer to the physical locations or settings where interaction occurs; rather, learning is constituted by the authentic activity of the learner within those settings (J. S. Brown, Collins, & Duguid, 1989; Moore & Rocklin, 1998). In other words, for faculty communities in higher education settings, the tasks, activities, and tools of the work of faculty teaching can create opportunities to engage in dialogue, inquiry, or investigation into the nature and meaning of those activities (Blanton & Stylianou, 2009). Faculty development within the community is "invisible" (Boud, 1999, p. 4). Faculty learning is not articulated as such by the faculty participants; rather, learning is an outcome of participation in the daily work of being faculty, such as planning class sessions, teaching, grading papers, conducting research, and exchanges with colleagues (Boud, 1999).

In this study, faculty were not newcomers to teaching, but were novices in working as a community on a curricular implementation. Faculty had different expertise in teaching and education. According to the theory, it could be expected that the faculty members would adopt the tools and language of those in the community as the activities of the community are shared and discussed.

The Continuum of Community. Communities of practice theorists argue about the degree to which the social context influences learning. In a *cognition-plus* approach, individual cognition is dominant and the social context is considered one influence on individual learning. In an *interpretive* approach, meaning is negotiated in interactions with the social context (Moore & Rocklin, 1998). A learner is both an agent of action, shaping the goals, values or practices of the community, and an object of action, where practices and interactions of the group influence the individual. Finally, in a "*social-only*" approach to the theory, the individual cannot be studied separately from the system (Moore & Rocklin, 1998, p. 105).

For faculty learning in communities, one outcome could be that community collaboration *would* result in individual learning that is taken from the program implementation context to other areas of faculty work. In the case of organizational change, it could be beneficial that community learning would influence the individual cognitions of faculty and the institution at large.

For change in medical education and clinical research training to occur, it is hoped that individual learning that is a result of participation in the community would influence the broader academic community. Therefore, the *interpretive* community of

practice perspective, in part, guided this study. A faculty member is both an agent of action, contributing to the values or practices of the community, and an object of action, where interactions of the group may influence the individual. In the context of communities and learning, the "human activity of individuals is constituted in communities, and the relationship is mediated by artifacts and rules or norms of behavior of participants in the community.

Distributed cognition

"Communities represent one way to divide labor including tasks, power, and responsibilities" (Cole & Engestrom, 1993, p. 7). A second sociocultural perspective offered for this study is *distributed cognition,* where thinking and learning are considered shared, or distributed beyond just the mind of a human being, and involve others, artifacts, media, and the environment (Pea, 1993, Perkins, 1993, Salomon, 1993; see also Moore & Rocklin, 1998). In a faculty practice community where cognition is distributed "individual expertise itself depends on distributed cognitive processes and grows from shared cognitive experiences that are non-routine, controlled, and deliberate and that produces artifacts that further serve to distribute cognition" (LaBeau, 1998, p.5).

Theorists differ in the conceptualizations of distributed cognition and these differences center on how widely distributed cognitions are within a social system. The *"person-plus"* view, represents either the surrounding physical and social elements or the "residue" left by thinking about external elements of the social setting that remain in the system, such as from tools or artifacts (Perkins, 1993, p. 90). Salomon also labeled this a *dynamic-interactional view* of distributed cognition, where cognitions are shared across

elements of the system, including the individual and social context and artifacts (Cole, 1992; Lave, 1991 as cited in Salomon, 1993, p. 112). In a *social-only* view of distributed cognition, all cognition resides in the social system, and cannot be analyzed in terms of an individual unit of analysis; the emphasis is on group activity.

In the dynamic interactional view, changes in individuals from their social interactions leads to changes in the quality of future interactions and their outcomes; the relationship between individual and distributed cognitions is depicted as a "reciprocal spiral" (Salomon, 1993, p. 123-124). I adopted this view in the present study primarily because of Salomon's suggestion that individuals' higher order representations are a critical component. In a social only view, he argues, a system can be static; inclusion of the individual allows the system to move forward when "action is blocked, requiring reflection" (Salomon, 1993, p. 134). I also applied Salomon's interpretation of distributed cognition theory, a *dynamic interactional* approach, because of the emphasis on shared cognitive labor and reflection on the activities of the community, which facilitates functioning of the system.

For this study, I held the view that situated learning in communities of practice is *interpretive.* These theoretical positions do not exclude, but subsume, cognitive theories of learning; however, the degree to which individual cognition plays a role within each varies. In both theoretical positions, the individual is a component of the analysis, not the social system exclusively.

Theoretical Summary

It is important to consider the role of social context to explain how people learn in certain settings (Cobb & Bowers, 1999; Derry et al., 1998; Lave, 1991, 1993; O'Donnell, 2006). Faculty development occurs in a social, political, institutional system that facilitates (or constrains) learning and that system has the potential to influence faculty learning (O'Sullivan & Irby, 2011). The socioconstructivist theories of distributed cognition and communities of practice may provide broader explanatory support for understanding the role of faculty communities for faculty development in the workplace context.

Chapter 3 Summary

Faculty development is an important component of medical education. Prior to the 1980's, faculty development was focused on teaching improvement through structured workshops, seminars, or teaching academies (Gaff & Simpson, 1994; McLean et al., 2008; Menges & Austin, 2001; Menges et al., 1988; Y. Steinert, 2000; Y. Steinert & Mann, 2006; Yvonne Steinert et al., 2006; Wilkerson & Irby, 1998). Research on these structured faculty development initiatives provided significant insight about what and how faculty learn; yet, literature reviews of the last 30 years revealed inconsistent outcomes of intervention studies and a gap in the literature for understanding authentic professional faculty learning outside of these formalized programs or workshops, especially for experienced faculty (Amundsen & Wilson, 2012; Roberts, 2012; Y. Steinert, 2010; Yvonne Steinert et al., 2006; Webster-Wright, 2009).

This chapter aimed to provide additional background of the primary activities and areas included in faculty development in medical and higher education, such as instructional, organizational, personal and career development, barriers to faculty development participation and new perspectives in faculty development research. The activities subsumed within faculty development form the basis for variety of developmental activities that could be fostered within a faculty practice community. As this was a study of a faculty community implementing a new curriculum, the chapter also reviewed types of faculty communities defined in the literature and some of their characteristics. Further, the chapter extended the current definitions of faculty community available by emphasizing the workplace context of the faculty practice community studied herein. In total, this chapter literature is important to understand how faculty development efforts evolve alongside new curricular models of medical education, in concert with more recent socioconstructivist views of learning. The next chapter reviews models and processes of reflection and their connection to the study.

CHAPTER 4

LITERATURE REVIEW

Reflection

A central hypothesis of this study of faculty community is that members learned through working together to address instructional and program implementation needs. Learning was an outcome of collaborative reflection on these community experiences. The purpose of this chapter is to define and synthesize the characteristics of relevant reflective practice models from teaching and health professions literature. The chapter then focuses on several faculty studies of collaborative reflection. Finally, I conclude with the research questions explored in this study.

Defining Reflection in Professional Practice

Literature on *reflection* (also referred to as reflective practice and reflective thinking) is particularly voluminous in the areas of in pre-service K-12 teacher education (Clegg, Tan, & Saeidi, 2002; Hatton & Smith, 1995; Sparks-Langer & Colton, 1991; Zeichner, 1994), in professional health sciences education (Atkins & Murphy, 1993; Clegg et al., 2002; Droege, 2003; Jarvis, 1992; Johns, 1995; Mann, Gordon, & McLeod, 2009; Moon, 1999; Ruth-Sahd, 2003; Schön, 1983, 1987) and workplace and adult education (Ferry & Ross-Gordon, 1998; Mezirow & Associates, 1990). In professional workplace based learning, reflection on one's practice is viewed as a mechanism for continual learning and mastery (Harris, 2011).

A universal definition of reflection eludes researchers; however, reflection may be defined as a "basic mental process with a purpose or outcome, that is applied in ill-

structured and uncertain situations where there is no obvious solution" (Moon, 1999, p.10). Collaborative reflection is the process of reviewing one's experiences with colleagues, whether in a small group, with a peer, or through observation and discussion (Cooper & Boyd, 1998).

Donald Schön in his seminal book *The Reflective Practitioner* (1983) describes an *epistemology of professional practice*. This epistemology captures the nonlinear context of practice-base learning that characterizes fields like teaching and medicine. Reflection is a method of learning from experience and for making-sense of the non-linear problem-solving processes (Schön, 1983). In higher education teaching, reflection as a mental process attempts to answer the question of how teachers integrate the theoretical and research base of education into the daily activities of curriculum development and classroom practice (van Manen, 1977).

Historical Background

In education, the roots of reflection may be attributed to Dewey, although Habermas has also been described as another important philosopher in the reflective practice literature (Moon, 1999). Dewey describes reflection as a social and individual process of inquiry (Rodgers, 2002). For Dewey, reflection was necessary to promote thoughtful teaching (Zeichner & Liston, 1996). Dewey wrote that intellectual growth is about the continuity of experiences and how those earlier experiences form the basis of future, albeit, modified, actions and thinking; he viewed education as this continuous process that necessarily involves social interaction (Dewey, 1938).

Dewey defined reflection as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (Dewey, 1933, p. 9). Reflection is a meaning-making process that moves a learner towards deeper understanding of their educational experiences (Rodgers, 2002). Reflection occurs within a social community where one values personal development of the self and others; it is a systematic, rigorous way of thinking (Rodgers, 2002).

In the early seventies, Habermas suggested that reflection was a tool for "the development of particular forms of knowledge" (Moon, 1999, p. 13). Habermas believed that the interpretation of and integration of ideas was a way to understand human behavior and, at its core, a way towards emancipation of social groups towards equality, and social justice through the transformation of the self (Cranton, 2006; Mezirow, 1991; Moon, 1999). Habermas saw reflection as freedom from oppression, as is understood through the lens of critical theory (Cranton, 2006; Moon, 1999).

Dewey's concern was with the use of knowledge in effective education (with roots in scientific inquiry). While the mental processes of reflection in each of these philosophical views bears some conceptual similarity, the outcome differs. For Habermas, reflection resulted in social emancipation and transformation, for Dewey, reflection means in learning and intellectual growth (Moon, 1999).

Dependent upon the context and those involved in the educational setting or process, these views are not mutually exclusive. Both Dewey and Habermas' views are important. Dewey's links to educational work of faculty and in community, where

political, relational, gender, or hierarchical factors can influence group relations; social transformation may be a potential outcome.

Making Sense of Reflection

There are certain assumptions implicit in the definition of reflection. First, an individual must be willing and able to reflect and their memory and cognitive functioning needs to be intact in order to do so. It is also assumed that certain outcomes will result as a matter of engaging in reflection, i.e. learning, personal transformation, or cognitive development (Merriam & Caffarella, 1999). This section synthesizes key characteristics of reflection.

Problems as Stimuli. Reflection is triggered in response to a failure, perplexity, or doubt; encountering novel problems, or having a lack of experience in an area (Dewey, 1933; Schön, 1987; Mezirow, 1990; Moon, 1999; Rogers, 2001). Although the faculty in this study reported that they have a lot of teaching experience, none of them have implemented a new curriculum. Solutions to the problems they encounter required collaborative reflection on the choices, actions, and alternatives needed to for the community to move forward.

Brookfield (1995) suggests that teachers instinctually seek out experts who can help solve teaching related problems, rather than spend time trusting and reflecting on their own experiences as a source of knowledge for problem solving. Alternatively, problem solving may be approached through the critical analysis of one's own and others' teaching experiences (Brookfield, 1995).

At this experienced stage of professional practice, faculty colleagues may be influential in supporting, surfacing, challenging, and questioning colleagues' tacit beliefs and assumptions as they perform their academic roles (Van Manen, 1977; Mezirow, 1990).

Action as an Outcome. Dewey emphasized that reflecting on teaching informs future actions within the classroom. Mezirow (1990) action following reflection is a necessary component of reflection. Action is what distinguishes reflective practice from daydreaming (Dewey, 1933; Boud, Keough, & Walker, 1995). Reflection occurs as a result of an implicit need to change behavior or actions (Andrews, 1996 as cited in Ruth-Sahd, 2003). Schön claimed that the hallmark of an expert is continuous reflection on practice in order to improve his or her future performances, as opposed to applying routine actions in an increasingly efficient manner (Daley, 1999; Schön, 1983).

Focus on Self or Others. A focus on self and feedback from others in the reflective process may also contribute to personal or career related development or transformation (Mezirow, 1990; Kreber, 2009). In clinical teaching, studies found that an examination of teaching successes and failures lead to increased ability to for faculty to self-regulate (Pinsky & Irby, 1997; Pinsky, Monson, & Irby, 1998)

Collaboration in community holds potential for faculty development that is ongoing and continuous, and although challenging, reflection in collaboration is a process "capable of generating substantial professional development among faculty across a range of disciplines and with disparate levels of experience" that may have long-term effects (Clayton & Ash, 2005, p. 163).

Faculty used weekly meetings a primary method of communicating their experiences and getting feedback or comparing those experiences with colleagues. Reflection in the community was iterative, reciprocal, and dialogical. While reflection can follow a sequence in instruction, it was not a linear process. Faculty observed their colleagues, reflected on their own experiences, experimented with instruction; framed problems, tested and modified their individual and collective future action.

Social Context and Emotional Factors. The social context enables or discourages reflection as does sufficient time, comfort, personalities, and perceived value of the activity (Boud & Walker, 1998; Mann et al., 2009). Context includes individual factors, environment, and situation (Rogers, 2001). Trust among colleagues and respect for group members contributes to the utility of reflective interactions. In learning communities, the level of trust between members that can develop provides a fertile ground for reflective dialogue (Eddy & Garza-Mitchell, 2011).

Hierarchy, distrust, and perceived injustice may discourage reflection. Returning to an experience that one finds uncomfortable or a challenge to currently held beliefs might be avoided. "Critical friend dyads" and peer and professional groups play an important role in questioning and confronting others in planning, implementing and evaluating teaching (Cooper & Boyd, 1998; Hatton & Smith, 1995, p. 40).

Important aspects of if the faculty community will engage, or not engage, in reflection included emotional and social support through building trust and respect. Encouraging supportive feelings about the process of reflection will ultimately influence whether individuals engage in the process (Boud, Keough, & Walker, 1985).

Reflective Processes and Levels. Many reflection researchers agree with Dewey that problems are stimuli that trigger reflection, but researchers differ in their views about reflective processes and sequences (Hatton & Smith, 1995). Surface to critical levels of reflection correlated to professionals with more teaching experience (Ramsden, 1992; Hatton & Smith, 1995). There is also a reflective plateau where more experience may mean less reflective capacity as practice becomes more routinized, and disciplinary knowledge becomes more tacit (Mamede & Schmidt, 2005). Lower or more technical levels of reflection are not negative, but should be construed as another teaching tool used dependent upon the circumstance (Zeichner, 1994).

In a qualitative study using a think aloud protocol, researchers found that whether teachers were novice or experienced, they used reflecting in and on their actions during teaching as a means to develop expertise (Ferry & Ross-Gordon, 1998). Teachers reported evaluating and reflecting on their teaching regardless of their level (Ferry & Ross-Gordon, 1998). The next section reviews models and processes of reflection.

Models and Processes of Reflection

Reflection is depicted as different levels or a process with different phases. Several reflective models and processes will be discussed in this section beginning with three models of reflection in teacher learning: (1) Van Manen's (1977) three-level model of teacher reflection; (2) Hatton and Smith's (1995) levels of reflection in teacher learning that extends Schön's (1983; 1987) reflective competencies, and Brookfield's (1995) four lenses of the critically reflective teacher. Two additional models of reflection are described: (1) Boud, Keogh, and Walker's (1985) three-stage model of reflection in

learning because of its description of affect in reflection and (2) Mezirow's (1990, 1991) six hierarchical levels of reflection as it ties to the scholarship of teaching (Kreber, 2005).

Van Manen's Three-Levels (1977). Aligned with Deweyian views, Van Manen considers reflection a mental process that is necessary for educators' to analyze their practices in a more objective and increasingly critical manner (Moon 1999; Zeichner & Liston, 1987). Van Manen described three levels of reflectivity: *technical*, *practical*, and *critical*. *Technical* reflection is a basic reflective level, in which an educator is concerned with the efficient and effective application of educational activities and making choices that are aligned with the accepted practices or norms of an institution (Zeichner, 1994; Zeichner & Liston, 1987).

The *practical* level refers to "the process of analyzing and clarifying individual and cultural experiences, meanings, perceptions, assumptions, prejudgments, and presuppositions for the purpose of orienting practical actions" (van Manen, 1977, p. 226). At the practical level, a teacher is focused on explaining or connecting what is done (action) with an outcome, and making judgments about its consequences or worth (Zeichner, 1994; Zeichner & Liston, 1987). Practical reflection in teaching and learning is a process where teachers develop common understandings through communication with others while also making decisions about the quality of the teaching and learning experience (Van Manen, 1977, p. 226-227.)

A critical level of reflection is about educators' "conscientization" (Freire, 1970, p. 70-71 as cited in Van Manen, 1977, p. 221). Conscientization occurs when teachers continually examine, rather than accept, the "sociocultural reality that shapes their lives

and of their capacity to transform it" (Van Manen, 1977, p. 222). In this process, they may arrive at a just, equitable community, where there is no dominance among participants in the educational process. In other words, rather than the "sage on the stage" (King, 1993) faculty valued the importance of students contributions in an equitable, effective educational process. Reduction of dominance required suspending the common belief that the expert is there to impart knowledge to others. Van Manen's (1977) model is important to this study because it applied to curriculum development and teachers' educational decision-making.

Schön's Theory of Reflection (1983, 1987). Donald Schön's (1983, 1987) theory of reflection is often cited within the professional literature. Schön viewed reflection as a means to integrate the non-rational and dynamic processes experienced by professionals, like physicians, in the course of engaging and learning from practice-based experiences. Schön describes two main types of reflective actions. *Reflection in action* is thinking while doing, and reflection on action, or retrospective evaluation, or thinking through an action after it has happened (Schön, 1987).

A practitioner uses familiar or existing knowledge to interpret a situation. For example, a physician who is an expert in metabolic diseases builds a network of symptoms of diabetes, including physical and biological presentations. This network speeds her ability to recommend treatments, recognize complications, or perhaps diagnose new cases. When she sees a new patient, she may draw on two sources of knowledge: existing declarative knowledge about the disease and procedural knowledge in the assessment of the patient. While she performs the examination, she is making

judgments, asking questions, gathering more data, and continually comparing the evidence of the patient situation against her existing knowledge. Schön labels this reflection in action. *Reflection-in-action* involves "thinking on your feet" or using existing or prior knowledge in thinking about what you are doing as you do it (1987, p. 54). Reflection in action requires both a command of one's procedural or declarative knowledge and its retrieval, but also an evaluation of that knowledge in the context of skill performance. It is an active mental process of experimentation and testing.

At some point in the patient assessment, the physician may encounter evidence that is incongruous with her existing knowledge and experience of diabetes. She forms a hypothesis or question about the significance of the incongruous information. Following the patient examination, the physician reviews the case with a fellow colleague or supervisor, conducts research on the topic, or consults medical handbooks. *Reflection on action* occurs after an event, as the physician seeks to resolve her confusion.

Like Van Manen, Schön viewed technical rationality of learning in professional practice as a routine form of learning and skill application, which while important, reflected unexamined practices of a profession and therefore would not lead to expertise and innovation (Zeichner, 1994). As the physician creates new questions about problems in practice and seeks to solve them, she continually grows her knowledge and expertise. As the faculty community in this study systematically reflected on individual and collective practice it learned, growing the knowledge and expertise about the program.

Boud, Keogh, and Walker's (1995) Three-Stage Model of Reflection in Learning. David Boud and colleagues defined reflection as an "important human

activity in which people recapture their experience, think about it, mull it over, and evaluate it" (1995, p. 19). The authors described a three-stage process including: (1) returning to the experience (2) attending to feelings (3) re-evaluation. The re-evaluation stage included four aspects that contributed to learning from reflection: association, integration, validation, and appropriation. I included this model here because it is explicit about the role of affect, learner control, autonomy, choice, and the goal-directed behavior of the reflective process.

At first, learners *return to the experience* and the sequence of events that occurred. Their feelings about the event are considered and they will make judgments about their performance. During this phase, fine details of experience that may not have been attended to during the event may be reconsidered. A faculty member teaching using a new instructional method for the first time is a good example. During the class, her attention may be focused on executing the instructional steps. While focused on instruction, she may have difficulty attending to the student's experience of the session. Later, she may reflect back on the class, and recall what the students said or did that indicated the lesson was engaging or confusing.

Association in reevaluation (from an information processing perspective) is when the learner makes links between existing cognitive schema and prior knowledge. At this point in reevaluation, the learner may identify disequilibrium between existing knowledge, beliefs or assumptions. If new knowledge is useful, it is integrated. Integration is a "synthesis" of new knowledge (Boud, Keough, & Walker, 1995) or resolution of the state of disequilibrium.

Validation is the process of testing or experimenting with the new knowledge in new situations. Validation allows us to understand if the associations we have made are correct or consistent with the views of others on the same experience. For the faculty member, they may share the story with a colleague who uses the same instructional approach to see if he or she had similar challenges, or made similar conclusions about its utility or effect on learner engagement.

Appropriation is the final step in the re-evaluation process. During this phase the fundamental nature of our value systems and beliefs are altered. In other words, this is what we are about and this is who we are as teachers. In the case of the instructional example here, a faculty member may no longer return to another type of teaching. Her use of a new approach to teaching, say changing from a lecture-based method to an active learning method, may be the only way the faculty chooses to teach in the future. It is a part of their philosophy about learning.

Boud and colleagues' model is popular in the reflection literature although it speaks about how to promote reflection in the adult or college classroom. It is included here because it is explicit about the role of affect as a phase of reflection. Boud and colleagues' also refer to the influence of learner control, autonomy, and choice in individual reflective processes. These motivational and emotional factors are not explicit in other models and processes.

Table 4.1.

Models and Processes of Reflection in Professional Learning.

Author/Year	Description
Van Manen, 1977	Technical, Practical, Critical
Schön, 1983, 1987	Reflection in and on action
Boud, Keogh, & Walker, 1985	Reflection in learning. Emphasis on feelings/affect; Stages: Return to experience; affective evaluation, re-evaluation including: Association, integration, validation, and appropriation.
Mezirow, 1990, 1991; extended by Kreber, 2001, 2005; Kreber and Cranton, 2000	Six hierarchical levels: discriminant, judgmental, conceptual, psychic, theoretical, affective; Process, Content and Premise reflection on teaching.
Hatton and Smith, 1995	3 Phases of Development-Technical; Reflection in action, Reflection on action either as descriptive, dialogic, or critical. Follows a developmental sequence in learning to teach.
Brookfield, 1995	4 complementary lenses; autobiography as learner, perceptions of others, student's eyes, literature on research, theory and philosophy.

Mezirow (1991) Reflective Transformation. Mezirow's (1990, 1991) theory of transformative learning in adult education extends Habermas' views. A theory of transformative learning defines reflection as the "examination of the justification for one's beliefs, primarily to guide action and to reassess the efficacy of the strategies and procedures used in problem-solving" and as a synonym for higher-order mental processes (Mezirow, 1990, p. 5). Mezirow, like Van Manen (1977) suggested that reflection is a key factor in learning new meaning schemes through challenging old ones, with critical reflection the most significant in terms of "changing meaning perspectives and challenging the validity of prior learning" (Mezirow, 1990, p. 12).

Mezirow writes that reflection allows for transformation and emancipation of one's underlying meaning perspectives. Transformation is triggered by an event that may require learning new skills. The original theory included six levels of reflection (see Table 4.1), however; the theoretical framework was later examined and extended by Kreber (2001, 2005) to focus on three types of reflection (process, content, and premise) across three areas of teacher knowledge (instructional, pedagogical, and curricular).

Following Mezirow's theory of reflective transformation, Kreber (Kreber, 2001, 2005) suggests that in faculty development, faculty engage in three reflective steps: (1) reflecting on the content of a problem (what), (2) reflecting on the process of problem solving (how); and (3) reflect on the premise of the problem (why). *Content reflection* is about explicitly sharing one's knowledge about teaching, for example (1) "what instructional strategies do I use? (content reflection on instructional knowledge); what do I know about how students learn? (content reflection on pedagogical knowledge) and what are the goals of my teaching? (Content reflection on curricular knowledge)" (Kreber, 2005, p. 325).

Process reflection, or how teaching is conducted, is when a teacher analyzes the effectiveness of his or her teaching process. For example, faculty may ask themselves if what they did in class was effective and if so, how do they know it was effective? (Kreber, 2005). This stage of reflection is equivalent to evaluation or retrospective reflection on teaching (e.g. Schön's reflection on action).

Third, *premise reflection* requires teachers to ask themselves about the reasons behind their practice. This is equivalent to critical reflection, or reflections on "why" one

does what they do in teaching and the validity of the practice. For example, a faculty member holds the view that majority of faculty teach science through lectures and that this is the way it has always been. A faculty member asks themselves or their peers, "Why did I think lecturing was the best way to teach? Lectures didn't teach me to become a practicing scientist. What other alternatives are there?" In this example, premise reflection includes problem posing, not just problem solving (Mezirow, 1991).

Finally, Kreber states that the source of knowledge about teaching on which faculty reflect comes from two sources, their own experiences and the educational literature. This literature could be in the form of conferences, newsletters, articles, or peer-reviewed research publications. The literature may be theoretical or empirical. Similar to Brookfield (1995), Kreber's levels emphasize that faculty members' personal experiences are another source of justification for what they do, be it instructional experiences as graduate students or years of teaching experience.

In a study of thirty-six higher education science instructors, Kreber (2005) tested the extent to which faculty engaged in the three processes of reflection on teaching (e.g., premise, content, and process) across the three domains of teaching knowledge, (e.g., instructional, curricular and pedagogical knowledge). In a mixed-methods study, she interviewed participants, surveying them about their approaches to teaching science, and then analyzed the approaches to teaching inventory results using a repertory grid method (ATI; Trigwell & Prosser, 2004). The repertory grid method required participants to rate their individual teaching inventory results against nine different categories of reflection.

The nine categories of reflection formed a matrix (process, content, premise; by instructional, pedagogical, and curricular).

For example, on the approaches to teaching inventory the faculty indicated, "I feel it is important to present a lot of facts to students so that they know what they have to learn for this subject", then rated its relevance to the perception of the teaching task, "how relevant is it to know about other teaching strategies or methods" (Kreber, 2005, p. 335). The study compared grid results of both novice and experienced teachers. Kreber reported that experienced instructors rated perceived relevance of three areas: (1) process reflection on instruction and (2) process reflection on pedagogical knowledge, and (3) premise reflection on pedagogical knowledge as most relevant to their approaches to teaching versus inexperienced staff. These results were statistically significant.

Mezirow's (19910, 1991) theory suggests that reflection is tied to some subsequent action. Critical reflection is a mechanism for surfacing experiences, presuppositions, and beliefs and challenging the validity of them through discourse then making actionable decisions about those experiences that could guide future outcomes. As faculty engaged in reflection on their experiences in response to challenges, they made determinations about the actions needed to continue to move the curriculum forward.

Faculty "constructed and revised their knowledge as they engaged in content, process, and premise reflection" across the areas of instruction, curricular knowledge and pedagogical knowledge (Kreber, 2001, p. 85). As the faculty community began the program implementation they held different perspectives and beliefs about teaching and

learning. Through interaction with their peers, faculty struggled with problems surfaced in the implementation of new coursework and managing aspects of the curriculum, for which they have not previously been responsible. They observed one another in teaching, discussed their experiences in meetings, and provided feedback to each other about their observations. They reflected on teaching across the process, content, and premises of the instruction, pedagogical, or curricular knowledge.

Hatton and Smith's (1995) Phases of Reflective Development in Teaching. In teaching, Hatton and Smith (1995) proposed a developmental sequence that extended Schön's work and was similar to Van Manen's (1977) levels of reflection. The phases include: (1) technical reflection (2) reflection-in-action, 3) and reflection-on-action that progresses through three levels, *descriptive*, *dialogic*, or *critical*.

Like Van Manen's levels of reflection (1977), Hatton and Smith (1995) suggested that at early stages of teaching, novice teachers may be more concerned with technical reflection on the *tasks* (what) of teaching, for example, what topics to cover, readings to assign, and the best sequencing of instruction. Technical reflection is followed by reflection in action. At this stage in the sequence, teachers become more aware of *analyzing* (how) the effect of their actions in the classroom on student learning outcomes. When reflecting while teaching, teachers may adapt their strategies and approaches as they analyze the effects of their actions.

Reflection on action is divided into three specific types: descriptive, dialogic, or critical. Descriptive reflection on action is a *narrative* account of what happened during teaching. Dialogic reflection on action represents a higher level of reflection including

not only a narrative account of what happened during teaching, but also *self-judgments and exploration* of possible explanations or alternative events or actions (Hatton & Smith, 1995). Exploration may be by the individual or with peers.

Critical reflection on teaching is a teacher's recognition of sociocultural and sociopolitical influences of one's actions and *the larger context of teaching* in which one is embedded, and how sociocultural and sociopolitical influences manifest in teaching practice (Hatton & Smith, 1995). The Hatton and Smith (1995) model is included because it examines the development of the teacher, although its phases of reflective development were studied within pre-service teacher education. The faculty in this study were experienced higher education faculty.

Brookfield's (1995) Processes of the Critically Reflective Teacher. Drawing from Mezirow's theory, Brookfield (1995) proposed a critically reflective process whereby teachers continuously examine their practice for personal and professional development. The process requires four complimentary lenses: (1) knowing oneself through autobiography, (2) seeing oneself from the student's point of view, (3) receiving feedback from others, and (4) understanding teaching through reading the literature.

Before explaining how Brookfield conceptualized each of these processes, with an emphasis on self-evaluation through the lens of others, he describes "hunting assumptions" in reflection. Hunting assumptions are those "taken for granted beliefs about the world and our place in it" (Brookfield, 1995, p. 2). These are paradigmatic, prescriptive and causal assumptions. These assumptions determine our actions and interpretations of our environment.

Paradigmatic assumptions are the deeply embedded beliefs that drive our everyday actions, organize our reality and are the facts we believe to be true. These assumptions require disconfirming evidence to change and even in light of this evidence, faculty may still resist adoption of a new belief. In this study, for example, one faculty member stated could see no other way to teach biomedical content knowledge without lecturing. He held to this belief for many months, despite observed evidence to the contrary.

Prescriptive assumptions are assumptions about what we expect to happen in a given situation, guided by our paradigmatic assumptions. If we believe lecturing is learning, then without lecturing we may perceive no evidence of learning. Another faculty member attributed student levels of participation to lack of knowledge, rather than as a result of his lecturing or both. In this example, the faculty member's paradigmatic assumption may have been that *students are not experts, so they need me to tell them what they need to know. Additionally, when asked a question, students ought to know what I taught them and then provide the correct answer*. Both paradigmatic and prescriptive assumptions are the most difficult and uncomfortable to change (Brookfield, 1995).

Last, *causal assumptions* are predictive assumptions that are most obvious to the teacher. For example, if a teacher exposes their weaknesses or admits not knowing something, it allows students to do the same (Brookfield, 1995).

As stated, Brookfield's (1995) reflective process includes four complementary lenses: (1) knowing oneself through autobiography, (2) seeing oneself from the student's

point of view, (3) receiving feedback from others, and (4) comparing one's teaching to the literature. Connecting personal educational experiences to teaching helps faculty understand their own orientations to learning. Autobiographies, part of our prior knowledge, may be more impactful to developing teaching than directions about we should do in the classroom (Brookfield, 1995). But the risk in using autobiography in private self-reflection is that we may distort our own perceptions of our experience or deny the realities of that prior experience (Brookfield, 1995). We can also miss the value of that experience for teaching, which is why sharing personal experiences with others can be helpful or challenge us to consider our prior experiences in new ways.

A second element of being a critically reflective teacher, is trying to see teaching through the eyes of the students. Seeing teaching through students' eyes entails being aware of how what you intend to say is interpreted by students in the classroom. In this faculty community, the small size of the student group allowed faculty members to interact with students regularly. Through various mechanisms, such as course evaluations, solicited and unsolicited feedback, and small group class discussion, faculty received data that helped them to try and understand the students' experience of the curriculum. A trusting environment is one in which the students' feedback is anonymous without reprisal (Brookfield, 1995). Trust created a classroom and program climate where students expressed confusion, difficulty, or needed for further faculty support.

Faculty peers also provide another lens to examine teaching. When experiences are shared, faculty realizes the problems encountered in their own teaching are similar to those of their peers. These "collective dilemmas" may be resolved through polling

others' about the way they approached or resolved them (Brookfield, 1995, p. 31). For example, an educator may have difficulty with students' class discussion participation, so colleagues share what works for them in different situations. The faculty member may weigh these ideas and may select a strategy that would work depending on their class size and aims.

A final area of Brookfield's model comes from consulting the theoretical educational literature. Intuition about the "right way to teach" may be validated or elaborated by consulting the educational literature or, "naming" those facets of teaching practices, which may seem unique to an individual or situation (Brookfield, 1995, p. 36). For example, faculty may believe that his students are unwilling or unable to participate in discussion, regardless of his efforts. Understanding cultural differences in student learning may help the faculty member realize that the student's lack of participation is cultural, not a result of something he said or did. The literature can also help faculty understand student motivation, or to use effective pedagogical practices relative to the subject matter.

While each of these models or processes of reflection offers something different to understanding faculty learning, several studies provided additional insight about the role of reflective processes with others. The final section of this chapter reviews reflection through collaboration.

Collaborative Reflection

Both theoretically and empirically, evidence suggests that multiple sources and perspectives derived from small group interactions and dialogue encouraged the use,

development, and capacity for reflection (Hatton & Smith, 1995; Mann et al., 2009; Rodgers, 2002). Shared reflection is more effective because it offers multiple perspectives from multiple sources (Mann, Gordon & McLeod, 2009).

The prior section described the various models of reflection in the literature and synthesized the features and core characteristics of the construct. More specific to this study is how collaborative reflection in a faculty community contributed to faculty learning and development over time. Collaborative reflection is the process of reviewing one's experiences with colleagues, whether in a small group, with a peer, or through observation and discussion (Cooper & Boyd, 1998). Peers provide a lens through which our own experiences and perceptions can be challenged or highlighted (Brookfield, 1995). This section highlights several studies focused on collaborative reflection of faculty groups and how these findings connect with this study.

Collaborative Reflection on Research. In an action research project, three faculty members examined their collective experiences learning in a qualitative research methods course (Castle, Drake, & Boak, 1995). To study their own learning, they wrote reflections on their learning experiences, readings, and associated course materials. Faculty reflected on their teaching practices. Faculty recorded these reflections in written documents. Faculty shared the reflective writing documents with the other two members to read. After this reflective reading activity, faculty met to analyze and respond to each other's reflective writing. Each group meeting was two hours in duration with an open discussion of the previously reviewed written documents. No meeting agendas were used. The total number of meeting discussions was not specified. Faculty recorded field

notes about the conversations during other group members' speaking turns.

Faculty members' reported that collaborative reflection was a desirable working model and had longitudinal effects on their professional development. Specifically, they stated there was deeper satisfaction in the learning, enrichment in teaching and future research, and deepened personal interactions (Castle et al., 1995). Further, they described sharing through dialogue as a way to facilitate transformation of their perspectives about teaching and research. Sharing and trust emerged as an aspect of the study that contributed to renewal towards their professional roles (Castle et al., 1995).

The structured steps in the reflective writing process provided consistency, guidance and kept them on task, even though meeting discussions were open. One criticism of the study is that faculty stated that they all shared similar values and educational philosophies towards effective teaching and research. The common values may have contributed to the positive outcomes. It is unclear if the same result would come from a group with disparate educational philosophies. On the other hand, shared values around research and teaching research skills may have provided a common language and interests from which faculty could more readily focus on their work.

Collaborative Reflection on Teaching through Peer Observation and Feedback. In another study of collaborative reflection in teaching, Martin and Double (1998) tested a framework of peer observation and collaborative reflection to help higher education faculty develop teaching skills. The framework includes three phases: a pre-observation meeting, observation of teaching, and feedback meeting (G. A. Martin & Double, 1998). Pre-observation centered on preparation for observing a colleague, including planning the

meeting and establishing the outcomes for the observation. The observation component gave guidelines for what faculty should or should not do during teaching observation, such as write notes, being aware of body language, and remaining positive. The feedback component of the framework includes a description of what happened, intentions for the session, outcomes and perceptions and then the perspectives offered by faculty peers who observed. The researchers tested the framework with chemical engineering lecturers. The study did not cite the final sample size, referencing "two-thirds" of a department (p. 166).

The authors reported several conclusions that are relevant to this study. Faculty reported that the quality of the feedback including suggestions for improvement was helpful. Trust between colleagues was important to learning from the observation and the collaborative reflection discussion. However, the observation and discussion phases evoked high emotion for some who found the process stressful. The tone of the reflective feedback session was important. Respectful, private and constructive sessions were well received. The process of collaborative reflection allowed a focus on developmental needs related to teaching.

Some faculty reported that the observation and reflection process was too time consuming to engage in for a long periods of time. The framework progressed through three steps and training on the steps was needed to adhere to fidelity of implementation. This additional training time was reported as a downside of the process. As it was described, the framework was quite structured, unlike the meeting conversations in this faculty community study, where the collaborative reflection process could naturally

emerge (or not).

The study also reported that when faculty members perceived a professional commitment towards colleagues they will be more likely to engage them, despite busy faculty schedules (G. A. Martin & Double, 1998). Personal and professional commitments to colleagues enhanced faculty willingness to complete participation in collaborative reflection on teaching.

The researchers did not specify if the process was a one-time activity or repeated administration, so the study does not provide much insight to the role of the collaborative reflective process as a longitudinal developmental activity. What is relevant for this study of faculty community is that the authors attempted to capture the process of collaborative reflection in a model including pre-observation planning, peer observation, and peer feedback through discussions.

Collaborative Reflection in Faculty Meetings. In a more recent study of a small group of experienced medical teachers (*n*=5), three faculty meetings were convened to discuss professional development of teaching skills (Tigelaar, Dolmans, Meijer, DeGrave, & Van der Vleuten, 2008). The meetings were held every other month and a teacher trainer facilitated the meetings. The teachers raised critical issues or events from their teaching practice and their peers asked questions, gave feedback and suggestions for practice. The meetings were videotaped and transcribed. The transcripts were analyzed for types of faculty interactions, level of reflection, and the relationship between the two.

The researchers concluded that reflective processes were not linear, but discussions could span reflections on technical and practical concerns of teaching, (e.g.

how to manage disruptive student behavior), to political, emotional issues in teaching. For example, faculty concerns about failure with a curricular innovation and the view of oneself within the larger academic community. They also reported that three types of interactions were crucial for broadening the collaborative reflection process: *guiding/directing*, *proposing an alternative*, and *exploring an alternative'*(Tigelaar et al., 2008). These three interaction types resulted in two types of outcomes: new ways of acting, or new ways of thinking. For example, guiding and directing in collaborative reflection meetings included posing questions or comments from colleagues, such as "What if you pursued this approach with the students?" Proposing an alternative, and exploring an alternative could include: comments from colleagues such as, "You could say…or how about trying this…" (Tigelaar, et al., 2008, p. 296-297).

The study is important to this research for two reasons. First, the study demonstrates the range of reflective processes that occur in collaborative meeting contexts and the range of topics on which those reflective processes may focus. Second, there were three meetings videotaped over a six-month period, suggesting that collaboration provides an environment in which experienced teachers could benefit with repeated occurrences of interaction.

Chapter Summary and Research Questions

Many models of reflection have been presented in this chapter. Reflection is a social and individual process of inquiry that is reciprocally interacting (Rodgers, 2002). Reflective practice as a mechanism for learning in communities is influenced by the political, hierarchical factors that result in faculty action and decision-making.

Collaboration in the reflective process through community membership can be beneficial to faculty development across a range of professional and teaching competencies. This research explored the following research questions:

1. What activities of the community were triggers for collaborative reflection?
2. What is the role of collaborative reflection for advancing faculty members' understanding an innovative curriculum implementation?
3. What do community interactions reveal about the nature of faculty learning in practice?

CHAPTER 5

METHOD

This chapter describes the methods used to study the faculty community as they implemented an innovative curriculum in translational sciences. Data for this study were collected as part of a program evaluation that began in August 2011. I returned to the data and conducted the qualitative analyses.

There are seven sections to the chapter including: (1) approach and rationale, (2) the participants, (3) a description of the curriculum and instructional setting, (4) primary and secondary data sources and procedures; (5) data analysis steps; (6) establishing trustworthiness of the data; and (7) disclosures pertaining to the researcher's values about the community and its work.

Approach and Rationale

The observations, interviews, and artifacts of a faculty community were collected as part of a program evaluation of a new clinical research graduate training curriculum at a southwestern health professions campus. As the program evaluator, I observed classroom interactions, teaching, faculty meetings and the logistics of curriculum implementation. The evaluation data provided rich information about the experiences of faculty as I observed them discussing their collective experiences implementing the curriculum.

The primary source of data was naturalistic observation of classes, on average, three times per week and attendance at faculty meetings a minimum of two hours per week for fifteen months. The participants in the community include four faculty members and seven first-year students. Over the study period, I also collected data through interviews

of faculty and students, and an examination of artifacts of faculty community work. These artifacts included: instructional planning sheets, meeting agendas, classroom materials, a curriculum grid, competency table, and syllabi.

Ethnography

As a qualitative study, this ethnographic account is an interpretivist report of fieldwork. Ethnography refers to a systematic approach to studying groups of individuals through fieldwork which seeks to understand group formation, function, community sustainability, and shared values and language through interactions and experiences within the social life of the group (Allard & Anderson, 2005; Corbin & Strauss, 2008; Van Maanen, 2011). I selected ethnography as an appropriate method for describing the evolution of faculty experiences and learning longitudinally, as they performed and discussed their work as a community.

As a member of the program staff, I was provided with access to the faculty and all activities associated with the program. This provided opportunity to understand the socially acquired and shared knowledge available to the community members and to account for the observed patterns of activity, "the various forms in which people manage to do things together in observable and repeated ways" (Van Maanen, 1979, p. 539).

Access to the work of the community allowed me to engage them in the study, verifying my observations and questioning my conclusions through member checking. Member checking is a procedure for establishing the trustworthiness of the findings. Including faculty members in the research addresses a shortcoming of prior faculty development research. These shortcomings included: the lack of qualitative studies,

research including faculty as collaborators, and limited knowledge of learning by experienced faculty (Amundsen & Wilson, 2012; Levinson-Rose & Menges, 1981; Yvonne Steinert et al., 2006).

The following sections explain how researcher bias was addressed and the methods used to establish trustworthiness of the study findings. Trustworthiness in qualitative research is established through *credibility*, *dependability*, *confirmability*, and *transferability* of the data through multiple means (Lincoln & Guba, 1985).

Credibility. Credibility in qualitative research may be best accomplished by lengthy, continuous involvement in the setting under study (Lincoln & Guba, 1985; Van Maanen, 1979). Credibility of the study is a measure of the study validity that is derived from persistent observation of and prolonged engagement with the community (Corbin & Strauss, 2008). Fieldwork is characterized by full-time, daily involvement in the community under study, as a participant-observer in the settings where research subjects normally are (Allyn & Bacon, 1982). A researcher who is embedded in a community comes to understand daily life of faculty by "being there" in a persistent and prolonged way, revealing the varied aspects of the community's life (Lewis & Russell, 2011, p. 400). In this study, faculty community life includes course development, teaching, program administration, meetings, student learning and assessment, research, and university citizenship. Being there as a researcher meant attending meetings on a weekly basis, observing classes in both the medical school and graduate school, and collecting program evaluation data, including student course evaluations. I also participated in the administrative logistics of the program, so I had direct access to syllabi, course materials,

email communications, and institutional policies.

Dependability and Confirmability. Multiple data sources and triangulation of the sources address the *dependability* and *confirmability* of the study conclusions. Triangulation is conducted by gathering and comparing multiple types of data (in this case, three) rather than relying on one source of data. I used meeting agendas, observational notes, participant interview data, and artifacts from the community.

Dependability, a level of construct stability evident through the data, is important to the credibility of the findings (Lincoln & Guba, 1985). Peer-debriefing procedures were used to contribute to the dependability of the data. Peer debriefing is a method used to reduce researcher bias that may result from being a participant-observer. An expert in faculty development outside the community's department was recruited to discuss and review data coding and interpretation of findings. The expert worked in faculty development in medical education for more than twenty years, developing and training medical students, graduates, faculty, and fellows in faculty programs, like the teaching academy attended by Agatha and Gus. She holds a doctorate degree in social psychology and has experience conducting program evaluation in medical education. She has developed training for medical educators. She has also published educational research articles on physicians' professional identity formation. She worked at the same university but did not work in the same department. She was not a part of the faculty community.

As coding and results were summarized, we met bi-weekly to review the data, discuss the themes, models or concerns in the data. For example, when I had reduced the data to several episodic categories, I was confused about how to organize the episodic

timeline, where episodes repeated. She reviewed the themes and suggested that I divide the episodes up by each eight-week class segment during the academic year. By chunking the data in this way, I was then able to analyze the occurrence of these events in a more succinct way. Examining the data in total across the year was too overwhelming.

Second, she debriefed the study findings by reading each section of the manuscript for coherence with the evidence. When evidence or explanation was not clear, she challenged me to re-label sections, or provide notations or citations to support statements cited in the data.

Transferability. Transferability is determined by the research consumer through the level of data and information provided, so that judgment can be made about its utility in other practice contexts (Lincoln & Guba, 1985). The faculty community continues to be a part of the larger organization and therefore subject to the constraints of policies, cultural influences, faculty duties, and imposed limitations related to program activities. Data description is provided to allow readers to determine the transferabilty of the findings to other faculty community contexts, even if the contexts are bounded by different organizational constraints or environments. Generalizability may not be possible in the data but the research consumer determines the value of the results.

Assumptions

The study design is based on several assumptions of qualitative research as described by Van Maanen (1979; 2011) and Corbin and Strauss (2006). With a pragmatic orientation and a humanist bent in the tradition of John Dewey, an assumption in this qualitative research is that learning is dialogical and reflexive. Interactions

between individuals in solving the problems of their work and reflecting on them, contribute to insights, understanding, and potential transformation.

Schön (1983, 1987) viewed reflection as a means to integrate the non-rational and dynamic processes experienced by professionals in the course of engaging with and learning from their work. Engagement in reflective practice is most often triggered by perplexity or professional dilemmas that may not have linear solutions (Dewey, 1933; Mezirow, 1991; Schön, 1983, 1987). As the faculty community encountered program implementation difficulties, it provided the basis for critical discussion. The faculty community discussed course content and process, instruction, student and administrative issues, organizational events, and curriculum components as a basis to critically, and continually, evaluate their progress and actions during program implementation. Ontologically, participants' interpretations were derived from these interactions and socially constructed, filtered through the lens of their own belief systems and values (Allard & Anderson, 2005; Van Maanen, 2011).

An ethnographic approach is undergirded by the epistemological stance that knowledge is value mediated, meaning that the researcher and research subject influence one another (Allard & Anderson, 2005; Van Maanen, 2011). The findings of this study were mediated by my interpretations, limits to my understanding of scientific and biomedical knowledge, and ability to fully capture the environmental cues and activities that I attended to in observations. Understanding was negotiated between the individuals in this community, and the negotiation was through in-person discourse, electronic communications or diagrams on white boards as they externalized their thinking, or in

planning materials they prepared and shared.

Participants

Participants in the study include four faculty members and seven students (4 medical students and 3 graduate students). The age range of faculty was between 43 and 63 years old. One faculty member is female and three are male. They identified themselves as scientists at a mid-sized southwestern health professions campus, although two faculty have medical degrees. Faculty teaching experience ranged from 7-20 years with an average of 18 years' experience.

Each faculty member engaged in the full spectrum of faculty roles in teaching, service, and research scholarship. In addition to facilitation of medical school courses, members held various leadership roles in the university; two supervised funded research programs. Faculty duties included: teaching classes, grant and publication writing, scientific research, committee service, providing scientific counsel to local and national government agencies, administration, and student mentoring.

Student participants included four first-year undergraduate medical school students who held four-year bachelor's degrees in the biological sciences and three first-year doctoral graduate students who also hold four-year college degrees in chemistry and biological sciences. These graduate students were not MD/PhD students. The first-year student participants included five men (3 White, 1 Asian, 1 Hispanic) and two women (White). While the lens of the study focused on faculty, the students' interactions with faculty provided triggers for faculty work. In learning communities, one characteristic that evolved over time is the interconnectedness of faculty, student, and disciplinary

learning (Gabelnick, MacGregor, Matthews, Smith, 1990).

Faculty Participants

Agatha. Agatha (actual names of participants have been changed to pseudonyms) was a professor and medical doctor with eighteen years of experience as a faculty member and practicing pathologist. At the university's school of medicine, she was responsible for facilitating medical school courses, overseeing a curriculum committee and medical school track (a concentration area, i.e. global health, rural health, translational research), running a pathology laboratory, conducting autopsies, as well as, writing reports and discipline-specific publications.

Agatha had direct knowledge and experience in medical school curricular models, but not graduate biomedical curricula. Agatha became involved in the Translational Sciences Program after a biological science school faculty member, Rick, approached her in 2008 about graduate students attending medical school courses as a part of a revised curriculum for the program that he directed in the graduate school.

At the time Agatha was approached by Rick about possibly integrating graduate students in medical school courses, she was at a crossroads in her own career. She had lost research funding and revaluated her involvement in teaching science and engaging in scientific research. While Agatha did not have a prior working relationship with Rick, she showed interest in Rick's ideas due to her own philosophies about undergraduate medical education in the basic sciences. Agatha was interested in interprofessional models of medical education, where two or more professions learn together in order to

enhance teamwork, communication, and role understanding (H. Barr, 2007; Oandasan & Reeves, 2005).

As a faculty member, Agatha had been previously involved in a twenty-month long scholarship program in education and had participated in structured faculty development workshops, seminars, and conferences with educational speakers. By the completion of this study, she had co-published an article about an interprofessional medical school track in an international medical education journal.

Although Agatha saw her initial role as administrative, helping Rick work with the medical school, her prior educational training in science, interests, and experiences provided a foundation for her continued involvement and eventual full participation in the curriculum implementation. While she reviewed curricular modifications in the integrated medical school curriculum, she had not led the implementation of a new medical curriculum in its entirety.

Rick. Rick was a professor and scientist with eighteen years of experience as a faculty member and a background in physiology; he was an experienced cancer researcher and grant writer. At the university, he was responsible for facilitating medical school courses, overseeing the Translational Sciences doctoral program, writing grants to obtain funding to support his research, writing discipline-specific publications, and providing leadership to numerous university committees. Annually, Rick served as a national grant reviewer, responsible for scoring other scientists' grant applications for funding awards.

Prior to 2007, Rick was the director of a graduate biology program that was in decline due to shifts in scientific methodologies and the climate of cell biology research. With the National Institutes of Health roadmap (2005; NIH) including the emphasis on translational sciences, and private funding institutes offering seed money to start translational sciences training programs, Rick saw an opportunity to transition the declining graduate program into a more relevant graduate program focused on training translational researchers.

Rick had direct knowledge and experience with graduate biomedical science curricula, and had previously spent one year training in a medical school in the Northeast. Rick's experience having trained with medical students in his first year of graduate school was, in part, the basis for his curricular proposal to Agatha. Rick's beliefs about clinical collaborators in research also drove his educational philosophy, although he would not articulate this until several months into the program implementation.

Rick spent the last decade collaborating with a surgeon on a program in gastroenterology-related cancer research. He believed that effective clinical research required both scientists and clinical practitioners. Translational scientists with an understanding of clinical terminology could more effectively communicate with medical colleagues working with patients in order to inform the design, conduct, and eventual application of any scientific discovery. Conversely, Rick posited that medical professionals who understand and appreciate the complexities of the scientific research process could more effectively partner with scientific colleagues. Rick asserted, like many involved in translational research, that the depth of scientists' research skills

knowledge and the physicians' knowledge of diseased patients could be amplified when both professionals' expertise is collaboratively applied to finding cures and treatments.

While Rick was an experienced problem-based learning (PBL) facilitator, he did not generally participate in faculty development programs and workshops. Rick was not interested in educational methods or research and delivered his biology courses through lectures. Rick stated that he did not have time to attend conferences and seminars unrelated to his discipline or research. Like other biomedical scientists, he learned to teach through how he was taught, sitting in a lecture, and did not value pedagogical principles or educational research. While Rick was the program director, he had no experience implementing a curriculum innovation.

Gus. Gus was an assistant professor with a medical degree, PhD, and seven years experience as a faculty member. Trained as a pathologist, he managed a funded research program that investigated infectious diseases. He was responsible for facilitating medical school courses, served on institutional committees, directed a laboratory and a master's of science program, and wrote discipline-specific publications. Gus had direct knowledge and experience in both the curriculum of medical school and graduate biomedical science education.

As the more junior faculty member in the community, Gus was previously involved in a twenty-month long scholarship program in education and had participated in structured faculty development workshops, seminars, and conferences with educational speakers. Based on his own experiences of training in medicine and his doctoral work in experimental pathology, Gus had particular ideas of how his own educational experiences

could have been improved. Before moving to the United States from South America, Gus had interacted with educational experts from Harvard University and became interested in inquiry-based instructional methods. Gus had a self-proclaimed aversion to the lecture-based method he found was predominantly used in graduate biological science graduate education.

At the time of Rick and Agatha's conversations about Rick's program, Gus was planning a competency-based curriculum for an educational project, but he had not implemented the curriculum. In the faculty scholarship program in education, Gus designed the competency-based curriculum on which the innovative program was based. Gus was a newly trained PBL facilitator at the start of the program. Agatha introduced Rick to Gus and the three faculty members began discussing the potential contributions of each to Rick's new program.

Chip. Chip was a professor with a veterinary degree, PhD, and more than 20 years of experience as a faculty member. Following private practice in veterinary medicine, he returned to academia to conduct research and managed a funded research program that investigated infectious diseases. Chip joined the faculty team six months into the program implementation. When the faculty recognized they lacked expertise in biostatistics, Chip was invited to design and teach one course in the program on biostatistics. The faculty interviewed Chip before deciding he would direct the biostatics course.

Chip had significant experience teaching in traditional formats and his prior engagement in structured faculty development programs is unknown. Several months

after the research course concluded, Chip reduced his work schedule. His data are included in the study because of his substantive instructional contributions prior to his leave. Chip was not a consistent participant in faculty weekly meetings. While faculty considered him an important contributor to research-related instruction, methodologically, Chip was a negative case example against which the outcomes of full community participation were compared.

Description of the Curriculum and Setting

This section provides an overview of the curriculum and describes the program elements. The curriculum in Translational Sciences is a competency-based educational curriculum. The curriculum includes both medical students and graduate students collaborating in basic science courses in the first year of training, and in monthly, longitudinal educational activities thereafter. The implementation year is bounded by the academic calendar, which is August 2011 through July 2012. The Fall semester (August - December) includes student orientation, four first year 8-week courses, two second year courses, and research mentoring. This period of the research study focused on observing and documenting program structure and faculty interactions during classes and meetings. The Spring and Summer semesters (January-July) include four 8-week courses and research mentoring. This period of the research study focused on observing and documenting program processes and faculty interactions during class meetings, and student recruitment events. I continued my longitudinal observations into the second academic year (August 2012 –December 2012) primarily through meeting attendance.

Meeting attendance offered the most direct access to collaborative interactions. This academic calendar structure is important, as it was used to organize the results.

Setting. Observations of classes and meetings primarily occurred in one of three locations. The rooms were classrooms with central tables at which student and faculty were seated. At the front of the room, screens for projecting slide presentations or video were available. White boards were used in both PBL sessions in the medical school courses and in the PTSC graduate school courses. The rooms held approximately 10-12 people. The larger conference room with a similar configuration was used for student presentations and guest speakers. These rooms were located in two buildings on campus, one in the medical school where the PBL sessions were held and the other was a dedicated program classroom in a research facility.

Aims. The Translational Sciences program is designed to operationalize knowledge, skills, and abilities across seven core competency domains (communication and teamwork, research skills, management, teaching, professionalism, science content, and external services), and within each competency, across five skill levels (e.g. novice, competence, proficiency, expertise and mastery; Appendix A). The curriculum prepares Translational Sciences graduates with the competencies and skills to fulfill a variety of professional research roles in academia, government, or industry. Translational Research Track medical students may work as clinical scientists or practitioners while partnering with scientists in the conduct of clinical research. Time in research for future clinicians can vary from part to full time. The educational philosophy of the program is centered on interprofessional education and inquiry, so that students, both medical and science, learn

how to effectively question, generate hypotheses, and investigate those hypotheses individually and through multidisciplinary collaborations.

Organizational Level. The program represents an inter-institutional collaboration between the graduate school, school of medicine, and translational sciences institute at a mid-sized southwest university and academic health center focused on health professions related education at the graduate level. The university does not have undergraduate school, except one small program in nursing. The multi-school collaboration provides administrative structure, faculty funding support, personnel resources and classroom space to support the implementation of the program.

Departmental Level. The four faculty participants are assigned to several different departments including pathology and surgery. The participants teach in both the graduate and medical school. The new program consists of several elements that distinguish it from the undergraduate medical education structure presently in use at the university. The curriculum includes five distinguishing elements: (1) partnering graduate students with medical students in an interprofessional problem-based learning (PBL) curriculum in Year 1; (2) inquiry-based instruction in four new Practice of Translational Science courses (PTSC) for graduate students; (3) dual clinical and scientific team-based research mentorship; (4) an 8-week interprofessional summer research design experience; and (5) engagement in monthly, longitudinal interprofessional activities for Years 2-4 of medical and graduate school training (Figure 5.1).

In the first three courses in the medical school component, medical students in the translational research track and graduate students in the translational science doctoral

program attend class together as a group, or cohort, including problem-based learning sessions, cadaver dissection laboratories, and attending lectures on anatomy, radiology, and pathobiology. The integrated problem-based learning classes are three days a week from one to two hours.

Over the first eight months as each new eight-week schedule of classes begins, students remained in a cohort instead of rotating to different groups. The purpose of keeping the students together as a group was aligned with the aims of the program, promoting shared knowledge and experiences, identifying potential translational research questions of clinical cases, and building teamwork and communication skills. By the last course of the first year, it was expected that the cohort would demonstrate increased group cohesion, effective problem solving and resource sharing, as a result of the longitudinal interprofessional interactions.

In addition to course activities, students participate in team-based mentorship. This mentorship is structured through multi-disciplinary translational research teams (MTTs)(Calhoun et al., 2013). MTTs, with diverse expertise focused on specific disease problems, such as asthma or metabolic diseases, help to scaffold trainees in research skills, clinical knowledge, as well as modeling the leadership skills needed to manage a future translational research team.

Classroom Level-Medical Courses. Problem-based learning, or PBL, is an instructional method used in the three medical school courses. In PBL, students meet several times per week, working progressively through a case, documenting their thinking on a white board and then reflecting on the case and group process at its

culmination (Barrows, 1996; Hmelo, 1998; Hmelo-Silver, 2004). PBL promotes students' self-directed learning skills, interpersonal communication and professionalism, and provides tools for approaching patient diagnosis by integrating relevant knowledge within the context of its clinical application (Barrows, 1996; Bligh, 1995; Hmelo-Silver, 2004). In the medical school component, students also attend lectures related to the PBL course cases and engage in laboratory activities with their same PBL team members several times per week.

Classroom Level-Graduate Courses. Process-Oriented Guided Inquiry Learning or POGIL (Moog & Spencer, 2008) is the primary instructional method used by faculty in the new graduate school courses. POGIL is based on evidence that demonstrates students learn when they are actively engaged in learning and while interacting with an instructor as a facilitator (Bransford, Brown, & Cocking, 2000) The instructional goal is for students to learn scientific domain knowledge and research process skills *simultaneously* through POGIL.

For example, students analyzed data sets and scientific models, and they discussed problem-solutions in a team. The structure of students working in small groups with data and questions helped them to develop their own hypotheses and valid conclusions, modeling and recapitulating the scientific method. Two days per week, graduate students met for two hours for the POGIL sessions, these sessions occurred while the medical students attended the Practice of Medicine course. The four hours per week in POGIL sessions were the only instructional hours during the week that graduate and medical students were not learning together.

POGIL sessions follow a standardized format. Prior to class students read a research review article that defines and discusses terminology and biomedical models related to the subject of that day's course sessions. A typical session begins with an introduction by the faculty and a short 5-item quiz related to the pre-course reading. After 15 minutes, the quizzes are collected; answers to the quiz are debriefed as a group and discussed. The quiz discussion segues into the class activities. For the activities, a multi-page exercise worksheet is distributed (Appendix B). The worksheet includes the title of the exercise, learning objectives, the list of particular curricular competencies to which the activity relates, ground rules, and instructions. The worksheet also describes a post-course assignment and reading.

Students begin the self-directed portion of the work by choosing one of four roles: recorder, manager, questioner, or summarizer. The recorder documents responses to the activity questions on a worksheet that is submitted to the professor for a group grade. The manager keeps the group on time and task; the summarizer re-states the group's answers to check for both understanding and confirmation of the desired response for the recorder. The questioner may ask questions related to the activity, about related subject matter, record questions on a white board, or pose questions to the facilitator for the group, although others are not restricted from doing so.

After assigning roles, students progressively work through slides of data, microscopic slide stains (histology), anatomical images, or experimental animal models. As a group, the students examine the slides verbalizing their interpretations of study results, bar charts, and the like. They answer questions about the data, which are derived

from an article that they have not yet read, but are related to the topics of the pre-reading review article. At the end of the session, students will generally arrive at the same or similar scientific research model developed by the article's authors.

The facilitator role throughout the session is to observe group process and intervene with clarifying points. They may ask questions to move the group forward, or use question prompts to check for understanding. The faculty member may ask students to draw molecular and scientific process models on the white board as they progress through the session. The facilitator can also conduct a mini-lecture (shorter than 2-3 minutes) when students ask for clarification of slide content or a little more background on the topic. From time to time, the questioner records queries on the white board as they progress through the activity. These queries may be discussed later in class with the facilitator, or researched by students after class.

The session concludes with a group debriefing about the activity, discussion of the full scientific model, and preview of the reading for the related post-class assignment. The faculty member becomes a coach in the learning process versus the source of information.

Assessment. Class-level assessment consists of the POGIL discussion participation, POGIL worksheets, 5-item weekly quizzes, post-class assignments, peer assessment of group work, and group presentations of scientific research proposals. Rubrics are generally used for project based work and presentations. Rubrics outline the success criteria of the assignment and are provided to students in the syllabus. Rubrics are linked to competencies. For example, in the first Practice of Translational Science

Course (PTSC) course a group grant writing assignment is completed. The rubric reflects the grant categories and rating system used by the National Institutes for Health. Grant writing and submissions are a core competency of the translational scientist. Finally, a comprehensive essay- style examination is given at the conclusion of the course. The examinations mirror the critical thinking required in course sessions. Student must apply principles of scientific analyses, generate hypotheses based on data provided, or draw scientific models derived from a synthesis of reading. Each instructor develops a test question based on his or her session topic.

Facilitator Duties. All instructional development and implementation responsibilities are shared across the program faculty for each graduate school course. During the first semester of the program, faculty attended most sessions and observed their peers' implementation of the instructional methods. During assessment of student work (e.g. grant project presentations), all faculty members attend the student session. They complete the assessment rubrics and these are compiled for a final assignment grade.

Faculty (Agatha, Rick, Gus) acted as facilitators for each of the PBL sessions in the medical school component, as well as taking the lead facilitation role on a corresponding Practice of Translational Sciences Course (PTSC) in the alternating afternoons. This design is intentional, so that case content from the PBL sessions can be mapped to the basic science topics and activities in PTSC.

All faculty members facilitate sessions in the PTSC course series, but each 8-week segment is lead by one director who is responsible for the syllabus, assigning

faculty facilitator dates, and coordination of topics aligned with their medical school PBL sessions. For example, Gus facilitates the Gross Anatomy PBL sessions, and also PTSC 1, the first course in the new graduate program. The summer research design course is the exception, where Agatha and Chip lead the course, but Chip is the primary instructor due to his statistical expertise. Gus and Rick are guest facilitators on only two sessions.

In summary, this section described the study participants, the background of the program, structure of the curriculum at the organizational, program, and classroom level; its aims, the formats and methods of instruction and assessment, as well as detailed the shared responsibilities of its four core faculty members. The next section describes the data sources and collection procedures used in observations in the longitudinal study of this faculty community.

Data Sources and Collection Procedures

The study included data from several sources. The primary source of data was naturalistic observation of meetings and classes. Class observations were, on average, three times per week and attendance at faculty meetings two to three hours per week. Over an eight-month period, I also collected artifacts related to faculty work including instructional planning sheets, meeting agendas, classroom materials, a curriculum grid, competency table, and syllabi. A secondary source of data was ethnographic interviews of faculty and students. Notes from a faculty debriefing meeting (focus group) were collected at the mid-point of program implementation and recorded in a concept-mapping database.

Naturalistic Observation and Fieldnotes

An important element of the study was my direct observation of faculty discussions during weekly meetings and of classroom activites. I conducted classroom observation an average of three days a week in both PBL and POGIL-based courses for 82 days of observation between the 2011-2012 academic year (Table 5.1).

At the start of the program, faculty introduced me as a member of the curriculum committee who would be gathering evaluation data on the new program. Once these introductions were made, students did not ask me about my role in the classroom. At the start of each new course, I verbally requested permission from the directing faculty to begin my observations.

> *As part of the ongoing program evaluation of the new curriculum, would you mind if I attended the PBL component of the XXX class? During class I will observe and take notes, I am not there to critque your facilitation or participate, but to better understand the nature of interactions in the course. [Script of consent to observe]*

During observation, I sat in the back or off to the side of the main classroom table, where the students and the faculty member were seated. Due to limited table space, I used notebooks to record interactions and actions of faculty during classroom facilitation and program meetings. I did not video or audio tape classroom conversations. From time to time, I would ask the group (students and faculty) if they were comfortable with my attendance or if they needed me to step out of the room. Primarily, this issue arose when students were giving content-specific oral presentations or engaged in serious personal discussions (prior to faculty arriving) that had no relevance to the course or course faculty.

Table 5.1.

Observational Metrics for Curriculum Courses.

Course Title	Semester	Total Instructional Days*	Total Instructional Hours	Observed Days
Practice of TS 1	Fall	16	32	14
Practice of TS 2	Fall	16	32	10
Practice of TS 3	Spring	16	32	12
Practice of TS 4	Spring	16	32	7
Gross Anatomy	Fall	24	24	11
Molecules, Cells, and Tissues	Fall	24	48	3
Pathobiology	Spring	24	48	7
Biostatistics and Research Design	Summer	21	42	18

**Days are number of course sessions over an eight-week block; TS courses are eight weeks, twice weekly; Summer semester course is seven weeks, three times per week.*

My notes reflected faculty approaches to PBL and POGIL facilitation, turn-taking in discussion, and how a faculty either dominated or subordinated their role in classroom discussion. I also noted the changes in group dynamics, for example, divisive conversations, ethical debates, or comraderie, peer teaching and group cohesion. Since problem-based learning is a case-based and a student-centered instructional approach, commentary from the faculty should be limited to questions and points of clarification, with a focus on the group process. Faculty should ensure that students identify learning issues, hypotheses, facts, probe for exploration of a topic, adhere to ground rules and manage time.

In addition to the classroom observations, occassionally faculty would walk out of the classroom at the end of a PBL or POGIL session and describe how they were feeling about the session. These were impromptu conversations, where I would listen and record

what I could recall in a memo or notebook when I got back to my desk. I sometimes I typed notes into my cell phone notepad application. These conversations were often direct reflections on faculty performance, or their observations of student interactions and group dynamics.

While my intention at the onset of the research was to attend all classroom sessions, this was not practical. Before I made the decision to randomly attend, a comment was made by one of the faculty members about my presence as an educational monitor. The concern that my anticipated presence might have Hawthorne effects on faculty and student normal behavior confirmed my decision to randomly observe. I randomly attended sessions after the first 8-weeks. The risk of this practice was that I could miss significant moments of faculty learning and detailes of episodes that preceded reflective opportunitites.

Limited observation of courses in the second 8-week medical school course was due to a work-related scheduling conflict. I did not intervene in the classroom activities during my observations. I did not discuss my notes with other faculty or students.

Faculty Meetings

Weekly Meetings. Each week faculty met to discuss the relevant issues related to the program. These topics varied and were recorded on a weekly agenda. The meeting conversations could focus on any number of issues including division of work responsibilities, assessment, student issues, administration, lesson strengths and shortcomings, or course planning. I took notes during these meetings. The meetings

were the most significant sources of faculty collaboration and reflection on program implementation.

Mid-program Debriefing. After six months of program implementation, faculty participated in a 3 hour debriefing as part of an extended, normally scheduled meeting. The discussion points were captured in a concept mapping database called the *PersonalBrain* software. This software facilitated group reflection and provided a context chart (Miles & Huberman, 1984) for components of the program as viewed by the faculty at that time.

Ethnographic Interviews

Timing. At the end of the first academic year (July 2012-September 2012), faculty and students *(n=7)* participated in individual interviews forty-three minutes to one hour and nine minutes in duration. I used open-ended ethnographic interviews because while I had many informal conversations with faculty and students across the program implementation, these were short conversations. The end of the program year was chosen because faculty had more time available, allowing for an extended audio recorded conversation about their individual impressions and experiences during program implementation.

Purpose. These ethnographic interviews are important data for several reasons. First, faculty participated in a debriefing at 6 months into the program implementation, however their expression of individual motiviations and interpretations of the experience were limited. The debriefing focused mainly on operational aspects of the implementation. Second, faculty might have been reluctant to describe their personal

feelings of doubt, apprehension, or disagreement in front of colleagues. Last, the interviews added to the credibility of observational data.

Format. I was concerned that a set of interview questions would constrain or impose a desired structure around the conversation, as compared to provide a forum for faculty to share or reflect on events that they considered the major periods or events in the program implementation. Consistent with Spradley (Hsieh & Shannon, 2005) the ethnographic interview format was a natural language conversation, using prompt questions, as appropriate, to encourage faculty to discuss the program implementation and their feelings and experiences about collaborating with their colleagues on it.

The interview aimed to collect data on the following six areas: (1) initial development of the program; (2) their feelings about the program implementation; (3) roles of self/colleagues in implementation; (4) significant moments or memorable highlights; (5) potential contrary information e.g. the effect of a member no longer being a part of the community; and (6) evidence of science content knowledge learning.

Protocol. All of the interviews took place between July 21, 2012 and September 11, 2012 with 2 interviews in my office and 2 interviews in faculty offices. I informed the faculty member if we met at their office to try an plan for an uninterrupted hour, which they honored. I outlined in advance the focus areas of the interview on a piece of notebook paper to be consistent across interviews and to use as a reference for when natural breaks in conversation occurred, or a response was complete.

After confirming permission to record the interview, I explained that the purpose of the interview was to talk about the events that they considered important in the

program implementation and how they felt about the overall experience. Prompt questions were then used to seek clarification, elaboration, and contrary information, for example, "How did this group differ from other project groups or committees in which you have participated?" I did not take notes during the interview or use a script but at the start of the interview, I said:

> *Thank you for agreeing to meet and spend about an hour talking about your experiences with the implementation of the new Translational Sciences Program and working with your colleagues on the process. I would like to confirm, again, is it ok for me to record this session? (If an affirmative response from interviewee, I continued.) While our discussion will be recorded, I intend to assign you a psuedonym (or you can select one of your own), in order to maintain confidentiality of your identity. I will be the only person listening to the recordings and will not share them with supervisors or colleagues. As you know, this interview is a part of a research project I am conducting and excerpts of your comments may be used in that paper. Are you comfortable with me using the information in this way? (If an affirmative response from interviewee, I continued.) I really want you to do most of the talking because I am interested in understanding your experiences in the program more clearly. Do you have any questions or comments before we begin?(Interview introduction notes from 091112)*

Interviews were recorded, but since the interviews were not the primary source of data, once reviewed them in their entirety, I selectively transcribed the data. Since student participant responses often included statements of evaluation of the program overall, the field of translational science, or some comments about students' mentors, some transcript content was not relevant to this study.

Artifacts Collected

Throughout the time I was embedded in the community, I collected instructional planning sheets, meeting agendas, classroom materials, a curricular grid, competency table, and course syllabi. Instructional planning sheets were developed by the most

junior faculty member and shared with the other faculty. The purpose was to gain some implementation fidelity across the course sessions, which were divided among faculty. The planning sheets included a space for outlining session objectives, competencies, activities and corresponding assessment measures.

The curricular grid depicted the map of the courses and how they intersected with the medical school and graduate school programs. The grid also demonstrated milestones of the curriculum across the four years of training. The curricular grid was a communication tool used by faculty and students.

The competency table provided a list of the guiding skills, knowledge, and abilities of the translational scientist. The competency table provided a framework from which all curricular substance was designed. Syllabi were compiled for each new course according to institutional guidelines and requirements. The syllabi include the competencies to be obtained during the course, each session topic, dates for the class, the faculty responsible, or guest speakers coordinated to attend. These syllabi are a source of community memory and one of the shared communication tools that organized faculty work.

Trustworthiness

There are several criticisms about the ethnographic approach, such as a perceived lack of structure, subjectivity in the process contributing to problems of reliability and validity, and a lack of generalizability (Spradley, 1979). This section describes the steps that were taken to counter these criticisms and demonstrate trustworthiness of the study.

Trustworthiness requires the researcher to continually ask whether or not the findings of the study are going to be relevant, resonate, or "worth paying attention to" (Lincoln & Guba,1985, p. 290). Trustworthiness concerns the validity and credibility of the study to contribute theoretically, or to be applicable in other contexts. Trustworthiness is enhanced through prolonged engagement, persistent observation, triangulation, and member-checking (LeCompte & Goetz, 1982).

Establishing trust is an important part of trustworthiness of the data. There is a level of discretion required when conversation may turn personal, to exclude or represent that information, when relevant, in a way that does not erode future trust or relationship to the members of the community. Trust meant not sharing conversational or interview data with other members in the community. Through the development of the relationships with faculty, it was necessary to treat meeting conversations, classroom observations, and individual faculty comments with professional discretion in order to maintain the relationships and trust.

In this study, I triangulate findings from different data sources in order to confirm that categories and interpretations are consistent. Peer debriefing was used. In addition, members reviewed the results to confirm that my interpretations are consistent with their lived experiences. The member-checking process revealed gaps in the data.

Axiological Issues

As participant-observer, the relationship with the community is reflexive. I describe the interaction patterns observed and sometimes participate in or initiated (e.g. reflective group debriefing). This reflexive process is a dialogical one where each spiral

of reflection leads both the researched and researcher into increased depths of understanding in the interplay between theory and practice (Atkinson & Hammersley, 1994; Lincoln & Guba, 1985). Faculty planned the program in 2008-2009, I began working with the community in 2011. Faculty had a shared history, established ways of meeting, communication, and externalized understandings about the instruction and structure of the program. While I was initally ignorant of these patterns of interaction, the patterns and their significance would emerge as I began engaging with the faculty community over time.

Ignorance of scientific jargon and basic principles of biomedical science allowed me to be content free, to observe developing pedagogical content knowledge of faculty as they debated the best ways to facilitate instructional units, share work, and attain goals of the program with other members of the community.

Data Analysis Procedures

Due to the longitudinal nature of the study, the data analysis procedures are described in four steps. The first step includes early observations in the data through field notes, memos, and tracking the observations of faculty work as a community. In early observations, I made sense of the structure of the program and the varied tasks of faculty work in the context of a program implementation. These early observations were rudimentary, but set the foundation for understanding how faculty managed their work, made decisions and communicated in later months of the program implementation (January 2012 and forward). Part 2 of the data analysis describes coding steps and data reduction efforts, as well as the peer debriefing. In Part 3, I describe the episodes that are

triggers for the community to engage in collaborative reflection.

Part 1: Data Organization

Initial Observations. At the start of the program implementation and program evaluation (my initial purpose in the program), early observational data were detailed in notebooks. Entries were labeled with the class day number, week in the semester, and date, case or class topic (e.g. Class 1, Wk. 2, Burn Injury, PBL; Class 3; Wk. 7, Insulin Response, PTSC). If it was a meeting, "Meeting notes" was a heading.

These early observations provided a background for the study, documentation of the structure the program; program logistics, varied tasks of faculty work in the context of a program implementation, instructional methods, and conceptual impressions of teaching and learning within the community. While the notebooks were my primary data collection procedure, I kept computer folders labeled with different types of data. In total, I kept 5 computer folders for memos, agendas, planning documents, audio interview files, and the debriefing notes. Files within the folders were labeled with the master label name and the date (e.g. Agenda 02-01-2012; Memo 3-13-2012). The dates corresponded with segments of each semester, which correspond to specific courses.

The purpose in this early phase was to understand how faculty approached their work and interacted to address the needs of the program implementation. I returned to my notebooks repeatedly as I read different articles about faculty development, making notes about how different observations fit into categories of faculty development (i.e. instructional development, career development, organizational development, personal

development). I also made notes or diagrams about existing learning theories or theories of reflective practice in relationship to faculty discussions.

My notebooks reflect diagrams and maps of topics. For example, as described in the previous literature on reflection, the practice of reflection is often depicted as a cycle or process derived from experience and occurring before during and after an event. As I reviewed notes about faculty interactions, I compared what faculty did during meetings discussions to these phases of reflection. Occasionally, faculty members drew diagrams on the white board or in their classroom notes about how they viewed student learning and their own learning during the new program (interconnected clock gears or circle dash diagrams). I copied these images into my notes.

Notes also included impressions of differences between individual faculty members teaching and attitudes towards one another, through observations of class management, the materials and procedures used in classes, faculty observations of each other, use of technology in instruction, and the division of teaching and administrative responsibilities. I focused on how faculty shared tools for planning teaching and resolved conflict.

Artifacts. Community artifacts were collected. These artifacts included syllabi, planning documents, meeting agendas, a curriculum grid, competency lists, and program rubrics. Teaching planning documents were introduced into the program by the least experienced faculty member, Gus, and then adapted by other members of the community, as they divided the instructional work during new course implementation. Nine syllabi, 33 agendas, and 26 instructional planning artifacts were reviewed.

Part 2: Labeling Episodes

This study used episodes in the community as a unit of analysis. Significant episodes of work of the community represented the activities around which collective reflection occurred.

Meeting Agendas. The purpose of coding the agendas was to understand the types of activities or topics that faculty discussed most often as a community. Agenda items from 33 observed meetings during the period of August 2011- December 2012 were placed on a spreadsheet. Inclusion of an activity on a meeting agenda meant that the topic items ranked of sufficient importance to the community to warrant discussion. These shared discussions had the potential to "bring members into greater conceptual alignment" (Derry, DuRussel, & O'Donnell, 1998, p. 30) about the program implementation activities and priorities.

The raw data of 178 agenda items were listed by date and then coded, or labeled, according to the type of activity. The activities were related to major types of faculty development activities (i.e. instructional development, career development, organizational development, personal development). The spreadsheet was sorted by activity type resulting in 35 initial activity types. These activity types were analyzed again for overlapping activities and collapsed the list of 35 activity types into 11 activity types under which similar labeled activities could be subsumed. For example, several levels of instructional assessment activities were identified and labeled on the agendas. These assessment activities included: (1) program-level assessment at the competency level and state coordinating board level, (2) course-level assessment such as how learning

objectives would be measured (3) class-level assessment development such as rubrics, and (4) student-specific assessment. These four assessment activity types were collapsed into an overall *Assessment Activities* category.

Another review of the 11 themes revealed some further relationships. For example, course planning, development, and course management were combined into an *Instructional Development* category. These 11 macro-level categories were reviewed again and reduced to 6 macro-level activity categories. These categories are: (1) collaborative teaching and instruction, (2) organizational leadership and program management, (3) student affairs, (4) career and professional enhancement, (5) personal development, and (6) program assessment and evaluation.

I debriefed the data analysis process with a faculty development expert for feedback and critique. The final six categories from the agenda analysis represent the categories of faculty work that were triggers for collaborative reflection during meetings.

Field Notes and Memos. Once the faculty meeting activities were analyzed, I returned to the collection of field notes and memos in detail. Notebooks were labeled by date period (Notebook 1: 8/24/11-11/3/11; Notebook 2: 11/5/11-3/2/12; Notebook 3: 3/2/12 – 5/2/12; Notebook 4: 5/12/12-8/20/12; Notebook 5: 7/10/2012-8/1/12; Notebook 5: 8/31/12-12/2/12). There was some overlap in the dates of the notebooks. Overlap in dates meant the notebook included lists of items faculty wanted to follow up on or items that they listed as important to the activities of the curriculum. Because they didn't have time or opportunity to attend to a topic during that meeting and I wanted the next meeting notes to be included in that section, I started a new notebook for other observations.

These lists also included administrative notes or reminders for items that were my responsibility to complete, so while I had started a new notebook, I returned to the old notebook. For example, a reminder to submit student grades to the graduate school at the end of a semester. Date gaps in notebooks can be also be attributed to a weekend day, a vacation period, or a week where there was no classes or meetings.

Notebook review focused on particular evidence of reflective discussions during and after classroom instruction or meetings. First, I conducted a full review of all notebooks. I conducted open coding of each notebook. I used a highlighter to mark areas of activity around which there was a lot of discussion, such as student grading. After an initial review, I developed a preliminary list of episodes on a spreadsheet. I returned to the notebooks and reviewed each one. I entered quotes, descriptions, and notes into the cells on the spreadsheet. I completed this process for all notebooks. This process resulted in 17 distinct episodes, although the same episodes may have be the topic of discussion over several dates. For example, student study resources surfaced in classroom discussion on two occasions in the first eight weeks. Faculty reflected on these episodes during their weekly meeting in relation to providing adequate resources to graduate students. Once complete, I went through each quote or episode and assigned a label, similar to how I coded the agenda items. I returned to the completed data to see how it fit with the themes initially identified.

Initially, I independently coded the field notes, rather than applying the categories defined in the agendas analysis. After completing the field notes analysis, I noticed that the categories were similar. For example, in the first eight weeks of each new course in

the program implementation, a major emphasis was on activities associated with new course planning, development, and after a session was implemented, evaluation began. Peer observation contributed to evaluative conversations about instruction during meetings. For example, faculty discussed how the other members of the community operationalized the POGIL method; so there was a substantive amount of peer observation during this time. The meeting agenda indicated a particular class session (PTSC 3 Syllabus review) and then discussion began by reviewing the instructional activities of the prior week's sessions.

This similarity provided some validation that the activities I observed in classrooms and meetings, correlated to the faculty activities included on the agenda analysis. I returned to the field note data repeatedly to review the specific activities of the community. I compared these activities with the themes I developed from the notes and against the agenda analysis.

The field note analyses process resulted in a raw data list of 98 labeled episodes, or critical activities, that occurred during the program implementation. Similar to the agenda analysis, I listed the date of the activity, an excerpt or brief description of the activity into a spreadsheet. Once I completed review of the field notes and memos, I labeled each excerpt. A second review of the spreadsheet, I organized the activities into 17 major episodes. I compared these groups of episodes to the agenda analyses and determined the episodes could be categorized into five major themes. The episodes were organized according to these five themes: (1) instructional development, (2) student learning, (3) assessment, (4) organization and program management, and (5) career and

professional enhancement. Collectively, these themes correlated to the categories identified in the agenda analysis and were supported by the areas of activities identified in the literature on faculty development.

Once the field notes and agenda analyses were complete, I provided a summary of my findings to each of the individual faculty involved in the study. I then invited them to a meeting where we could discuss the findings. The purpose of the member-checking session was to review the analysis and to get their collective feedback on the validity of my conclusions. This discussion provided some further insight about how they perceived their group process, individual learning, and gaps in my interpretations.

Interviews. I listened to the recorded interviews several times after the initial recording. The first time I listened to determine the overall impact of the program implementation experience on faculty. The next time, I transcribed the interviews spending time with the data, making notes about participants statements and then determining how the themes and categories derived from these data might connect to or support the observational data and artifacts in order to enhance credibility of the findings (Corbin & Strauss, 2006).

I listened to the faculty interviews again after all the analyses and the field note coding was completed. These retrospective interviews provided a third source of data in participants' words about the personally memorable and significant experiences of the program implementation. Excerpts from the interviews were organized under each episode.

Part 3: Episode Synthesis and Triggers for Community Reflection

In this analytical phase, I mapped the episode occurrences across the study time period in a sequential, continuum of activity. I also looked for cross-theme synthesis of the episodes, determining which episodes were interconnected with others. The last part of my analysis centered on analyzing the results against two models of reflective practice, Mezirow's model of reflection as used by Kreber (2001, 2005; Kreber & Cranton, 2000) and Brookfield's (1995) processes of the critically reflective teacher. The purpose of this phase of the analysis was to compare the different types of reflective levels and processes to explain how the group used reflection to advance their understanding of the episodes within the context of these frameworks.

Chapter Summary

In summary, this methods chapter discussed several important methodological issues arising from the use of fieldwork. These issues include the role of participant observer, methodological disclosures and assumptions of ethnographic and qualitative research, data collection procedures, data analysis steps, and the efforts taken to ensure the credibility and trustworthiness of the results. With the methods and background for the study detailed, the next chapter focuses on the results of the analysis.

CHAPTER 6

RESULTS

This study explored how faculty used collaborative reflection to advance their understanding of the curriculum implementation. This chapter provides the results of the data analysis described in Chapter 5. The study sought to answer the following research questions:

1. What community activities were triggers for collaborative reflection?
2. What is the role of collaborative reflection for advancing faculty members' understanding an innovative curriculum implementation?
3. What do community interactions reveal about the nature of faculty learning in practice?

The results of the data analysis are presented in several ways. First, episodes are presented in themes. Under each of the theme headings, episodes within that theme are described and presented in their observed order of occurrence. A general description of the episode is given, and then evidence is provided. Second, I present a longitudinal episodic timeline. The purpose of the episodic timeline is to depict the order in which episodes occurred naturally within the program implementation, recognizing that some episodes, for example within instructional development, were repeated multiple times or ran concurrently with other episodes across the curriculum implementation. Third, at the end of the themes, a cross-theme synthesis describes how episodes within each theme connected to other themes. The episodes are followed by a chapter summary.

Research Question 1: What community activities were triggers for collaborative reflection?

The data analysis revealed that multiple episodes were triggers for collaborative reflection within the faculty community. To answer the first research question, a total of seventeen episodes are cited as triggers for community reflection during the program implementation. The episodes are organized around five major themes; (1) instructional development, (2) student learning, (3) assessment, (4) organization and program management, and (5) career and professional enhancement (Table 6.1). Within each episode, I provide descriptive examples of what the episode involved. Where applicable, the episode title is labeled using actual faculty statements, as indicated by the quotation marks.

Theme 1: Community Reflections on Instructional Development

This section, *Instructional Development*, describes five major episodes, or activities that occurred under the theme of instructional development. These five episodes are: (1) developing new instructional modules, (2) implementing new instructional modules (3) evaluating instruction, (5) experimenting with or extending the use of instructional methods, and (6) appropriation of instructional philosophies.

Episode 1.1: "Flying by The Seat of Our Pants": Developing New Instructional Modules. This episode includes faculty efforts to create new course modules using the process- oriented guided inquiry learning or POGIL (Moog & Spencer, 2008) instructional method. Almost twenty-six percent (25.8%) of meeting agenda items

related to instructional planning and development. Developing modules included, for example: scheduling topics in the syllabi, determining the details on individual session

Table 6.1.

17 Episodes as Triggers for Community Reflection

Episode	Episode Title	Episode Theme
1.1	"Flying by The Seat of Our Pants": Developing New Instructional Modules.	Instructional Development
1.2	"It's Like a Micro Experiment": Implementing Instruction	Instructional Development
1.3	"Some of the Best Planned Sessions...": Instructional Evaluation	Instructional Development
1.4	"It's All About the Process": Experimentation and Extension of Instructional Methods	Instructional Development
1.5	"Can You Imagine Any Other Way?": Appropriation of Instructional Philosophies	Instructional Development
2.1	"How Do You Know What They Know?": Managing the Expert Blind Spot	Student Learning
2.2	Student Affairs: Mediating Interpersonal Relationships	Student Learning
2.3	"Content Knowledge Doesn't Make you a Scientist": Scientific Dialogues	Student Learning
3.1	"We Need Another Rubric": Authentic versus Standardized Assessment	Assessment and Evaluation
3.2	Determining the Grading Basis	Assessment and Evaluation
3.3	"Do They Know Enough Structure And Function?" Assessing Student Progress	Assessment and Evaluation
4.1	Talking Politics: Negotiating the Organizational Structure	Organizational and Leadership Development
4.2	Using the "F" Word: It's All About Funding	Organizational and Leadership Development
4.3	Envisioning the Future: Institutionalizing Program Practices	Organizational and Leadership Development
5.1	"Clicking Intellectually"	Individual Career or Professional Enhancement
5.2	"I Learned So Much Science"	Individual Career or Professional Enhancement
5.3	The Scholarship of Teaching	Individual Career or Professional Enhancement

activities, reflecting on the competencies that would be measured by a particular lesson, discussing assessment of those competencies, and summer research design course planning.

During the pre-program launch, faculty engaged in a "planning period". Agatha states that instead of "discreet" instructional assignments and work being completed, there was a lot of group "meandering", where the group was "trying to figure out a philosophy, our approach" to the entire curriculum [Interview, 083112].

> Agatha: *We were trying to create a framework for the instruction, and the assessment, and then pretty soon recruitment was upon us, that was very scary, overwhelming, and that was a stressful period…. For me, the whole, this was overwhelming because it seemed so enormous...I think it [planning] was based on, it was informed by some stuff Gus would bring us from the literature, or that you know kind of lay press books, and then Rick and I both have a lot of experience teaching, so I think there was a very fertile period where we weren't actually getting anything on paper but we were talking in some way about what methods might be useful, what are not useful, what is, what do we envision, what is our product, what kind of students do we want to train, what's going to be the role of the interprofessional component? [Interview, 083112]*

While faculty later acknowledge how important this meandering period was to them "gelling" as a community, very few instructional sessions were actually designed [Memo, 083112]. There was a lot of pressure on faculty in the initial eight weeks of the program. Faculty jointly constructed the first syllabus for Practice of Translational Science course (PTSC 1) during pre-implementation curriculum meetings. Agatha recalled she felt like they were just "flying by the seat of our pants" every week and that "we had this curriculum grid, but no course materials prepared beyond the first session or two" [Interview, 083112]. During the first eight-weeks of the program, the focus was on creating modules for the first practice of translational science course (PTSC 1).

The curricular design required one faculty member to teach the majority of a PTSC course concurrent with their medical school course problem based learning (PBL) facilitation. For example, Gus led the PTSC 1 course and facilitated the medical school course PBL cases in Gross Anatomy. Rick lead PTSC 2 while facilitating PBL for the medical school course Molecules, Cells, and Tissues. Agatha led the PTSC 3 course and facilitated the medical school course PBL cases in in Pathobiology. Chip taught research design in the summer but did not facilitate PBL in the medical school. The estimated time spent on course development is depicted in Table 6.2.

Faculty expressed feeling like everything planned for a class session was "just in time" even though a class session took all night to develop [Memo, 121411]. A good example is Agatha being "down to the wire" on session planning, emailing Rick and Gus at 6:30 a.m. to review her session plan and for a last minute overview of a cell signaling type [Memo, 101311].

The development process began again in each eight-week segment of classes across the first program year. During the program year, faculty developed new instructional modules for a total of five courses, four sections of the Practice of Translational Science Course (PTSC) and the Research Design Class. Faculty simultaneously balanced instructional module development time, selecting instructional materials, teaching new instructional modules, and facilitating their individual PBL courses from August 2011-February 2012. The new modules that were developed for the program were: introducing students to the instructional approaches of the curriculum,

defining translational research, and the mechanics of respiratory physiology. There were 11 modules that needed to be developed just for the PTSC 1 course [Syllabus, 083111]. Table 6.2.

Estimated 2011-2012 Instructional Development Metrics

New Courses	Title	Instructional Units*	Instructional Hours	Est. Planning Hours^
Fall 2011 (2)	PTSC 1, 2	32	64	256
Spring 2012 (2)	PTSC 3, 4	32	64	256
Summer 2012 (1)	Research Design Course	21	42	168
Totals		85	170	680

Units are number of course sessions over an 8-week block; ^Faculty reported a minimum of 4 hours of planning time for each hour of instruction.

Gus realized the workload was overwhelming with his other faculty duties by the fifth week of the program, so he requested that faculty divide up the future PTSC course sessions [Memo, 100611]. As a result of this division of work, weekly meetings were a necessary activity for the coordination of the community's shared activities. Faculty observed each other in class in the initial semester and attended 2-hour weekly meetings. Dividing up the course facilitation in the PTSC course became a norm of the community. Course instruction and coordination was shared across the community. Meetings served as a forum where faculty could discuss their teaching experiences and compare how many hours they were investing in instructional planning or review topics for future sessions.

To standardize instruction, Gus developed an instructional planning template in the beginning of the program for his own use. The planning guide included six sections. These sections were: (1) identify learning objectives of the session, (2) Identify

competencies to be addressed in session activities (3) instructor notes section on the key concepts to discover (4) three tables for mapping the learning objective (knowledge, skills, attitudes or performance) with assessment method, class activity, and an explanation section for how assessment and activities aligned; (5) outline or "map" of the module; and (6) sections for faculty to document the reading materials (pre and post class) and document post-class assignments (Appendix C).

Rick did not create and share a detailed faculty syllabus for the second PTSC class in the second 8-week segment [Program Calendar, 103111-120911]. This created another "flying by the seat of their pants" situation for the coordination of faculty teaching efforts. While it created some faculty confusion, the lack of a PTSC 2 syllabus was more of a joke in the community, representing anything that wasn't done or was confusing for students. Faculty would joke and say, "yeah, like Rick's syllabus" or "oh, you mean they want to know what assignments are due?" or "No syllabus, whatever" [Memos, 111811, 112911].

In the first semester, the community was clearly not yet aligned in how it viewed the educational process and approach in the program. As Rick explained:

> Rick: *This is really important to my own development, the most significant impact that these two people had on me, and I think it was really Gus, because Gus is more overtly process oriented, for him from the beginning it was all about the process. And I have to say, my initial approach was all about the content. We were like chocolate and peanut butter. Totally separate, ya know, and I kept pushing the content, its about the content, how do we train these people to have enough knowledge about specific disease processes and have all the basic biochemistry, cell biology, molecular biology that they needed to be scientists, literate scientists, you know, how could we, cram this all into their heads..and develop these people, that could identify the important questions through their clinical interactions with physicians and then go into the laboratory and take*

> *these important questions and turn them into effective translational research. Gus' approach was all about the process, forget about the content, because we need to train them to be scientists, and he introduced me to terms like 'authentic learning' and 'guided inquiry'. I was like don't give me that psychological gobbely goop, that was what was in my head, it was what I thought, I had no idea what these terms meant, it was all way too touchy feely for me. I was like, what are you talking about? [Interview, 083112]*

The instructional planning and development episode included faculty efforts to create new course modules using the POGIL instructional method. Faculty engaged in efforts to align development and implementation of new program materials. The community participated in regular peer observation of both POGIL and PBL sessions twice a week for the first course [16 sessions; Memos, 082911-102811]. The faculty reflective process in meetings was triggered, for example, by what was observed in one another's sessions, development of new instructional modules, group decision-making about instructional content, and established syllabi as work communication tools.

Episode 1.2: "It's Like a Micro Experiment": Implementing Instruction. Even though the community members stated they had a shared philosophy of the program, a shared philosophy did not equate to uniform instructional implementation even when using the same planning document and instructional methodology. Instructional implementation refers to faculty decision-making in the execution of instructional modules. There were three main differences in faculty implementation of instruction that led to reflective discussions. One of the differences in implementation was in the level of integration of technology. A second difference was the degree of autonomy students were given during a lesson. The third difference was how much advance involvement faculty solicited from their colleagues.

1. Technology. The POGIL sessions included statistical data representation slides, histology slides, and visual diagrams of experimental animal models presented in PowerPoint. Students viewed the slides to interpret data and identify components of the cells shown on the slides, working through a series of questions about them. A computer and two televisions were purchased for instructional use in the program. Rick and Agatha struggled to integrate technology into the classroom, while Gus was enthusiastic about adopting new technologies. Gus demonstrated how he used the technology in instruction to project detailed cell slides and data.

The classroom had a large television monitor on which graphics could be displayed. Agatha and Rick were initially uncomfortable with using technology. Rick's early sessions, he used handouts with questions that guided students through the exercises. Later, he integrated student website searches for information relating to a lesson on cancer. All the faculty members emailed articles instead of posting them on the course website, Blackboard. They concurred that the site was not very appealing. Each faculty member used technology differently even though they all eventually used slides to convey visual information and graphics.

2. *Autonomy.* The first three weeks of the program [Program Calendar, 082911-091611] Gus led PTSC course sessions using a modified version of POGIL. Agatha tried to implement POGIL as designed, assigning roles to students. Rick did not initially use POGIL. A second difference was the degree of autonomy students were given during a lesson. In Rick's early sessions, students were the least autonomous. He did not complete a session plan or learning objectives and appeared disorganized [Memo,

111811]. Over time, as he became more confident in his teaching and had embraced the inquiry-process, students were given more independence to work through in-class activities and questions without interruption by what the faculty would label as mini-lectures, a 3-4 minute informational background talk on a topic. These mini-lectures were well received by students since often the subject of a lesson was in an area they may not have had advanced training, like genetics.

In Agatha's sessions, students were the most autonomous. She aimed to implement POGIL as designed, letting students struggle with problems for most of the session, using a worksheet of questions as an exercise guide (Appendix D). After she gave a brief introduction to the session, her role in the class was as a coach. She checked time, if students had questions, helped to lead them to a section of an article, or clarified slides, then lead a debriefing at the end of class on the process and outcomes.

Allowing full student autonomy was not easy for Agatha. She wondered about whether her silence could be misconstrued as a lack of expertise and wanted to strike a balance between facilitating discovery and maintaining credibility with students. In several classes, I observed her making circle-dash notes (Appendix E). The circle-dash notations kept her from defaulting to a lecture in response to students' confusion during PBL instruction. The circle-dash notes indicated chains in student discussion, with initials labeled for each student's turn taking. Spaces with a question mark indicated where she asked a facilitation question and notes alongside the circle-dash would indicate a topic thread. The circle-dash method was not only a self-regulation process, but also a reflection on students' learning for use in assessment. She used the initials of students on

the discussion thread to later determine how often students participated in class. Agatha used this method in both PBL and POGIL sessions.

Gus' sessions changed from week to week and while guided, students did not have the full autonomy of many of Agatha's POGIL sessions. In the first day of the curriculum, Gus presented the curriculum to students with an overview of the teaching method. During this instruction, there was discussion with students about how they felt they would best learn. They took an online assessment and then talked about it in class. This was not something the other faculty used. He used demonstrations more than the other faculty. These demonstrations included tools that had helped him, such as expert concept maps, setting up PubMed search strategies, a natural planning model, inductive space diagrams, and web-based resources for research supplies, like ordering certain types of mice. He also incorporated videos to demonstrate technical tools like a flow cytometer, which sorts cells and color-coded their types, providing a visual grid for analysis. The faculty community enjoyed observing Gus' instruction and read all the chapters of an experimental design book along with the class.

3. ***Involvement of Colleagues.*** The third difference among these faculty was how much advance involvement they solicited from their colleagues. This was an interesting issue, in that Agatha involved Rick and Gus in many of her session planning, either via email or during meetings, or through soliciting feedback on the syllabus for her course, PTSC 3. The other two faculty members did not solicit feedback in the planning stages, although they received feedback after a session was implemented and observed by their colleagues, whether solicited or not.

During Gus' interview, he equated implementation of instruction to the scientific experimentation process. Scientific experimentation is a good analogy for this episode of implementing instruction. Gus described the curriculum as a macro experiment and classroom as a micro experiment [Interview, 082312]. These faculty members were all trained in the biomedical sciences and the process of learning through experimentation was a natural part of their work and identities. If they tried something and it worked, they replicated it. If it didn't work, it was modified, replaced, or discarded. If it worked but was not quite right, it was modified. Patience and perseverance with the experimentation process was necessary because the time to discovery could be long. Implementing sessions and having them fail was not worrisome; it was conceived as an experiment so that it was slowly refined for the next time. Peer observation of sessions and discussion about them was a part of the refinement process. While faculty each had nuances to how they executed instruction, they were complementary. Agatha summed it up this way:

> Agatha: *Taking lessons from that first POGIL session and trying to figure out how that could work better, how I could how I could best utilize Rick's expertise in a way that was still consonant with my approach which I still think has some value I think there's a lot of value for the students, I don't now if there is any data to support this but I got by the end of the year, to the point where when the students are in a session with me they know that it is going to be a little more structured and they're going to be expected to work on their own, and there might be some faculty expert mini-lectures not mostly by me, and when they are with Rick, they might expect a more rigorous examination of the scientific principles and the big concepts really led by him. I'm expecting that's how his sessions went, and ya know with Gus they might be, ya know, kind of big picture, ya know, I don't know, Gus has a very supportive style of teaching so I just figured by the end of the year, the students were probably getting a different thing from each style of and that that was ok. [Interview, 091412]*

Episode 1.3: "Sometimes the Best Planned Sessions…": Instructional Evaluation

As faculty had experiences developing and then implementing the class sessions for which they were responsible, faculty meetings included more discussions on what happened in the classroom that did or did not work. Instructional evaluation episodes included instances where faculty analyzed the strengths and weaknesses of classes that occurred. Instructional evaluation became prominent during October and November 2011, just as the first course was ending and the second one was beginning. Several examples of instructional evaluation will be described in this section: (1) the strengths and weaknesses of the POGIL method, (2) physiological and scientific content coverage in the PTSC classes, and (3) critiques of their own and colleagues teaching or classroom performance.

1. ***Strengths and weaknesses.*** Rick analyzed his history of teaching after using POGIL and learning methods and how Gus influenced his own teaching, despite being the less experienced faculty member:

> *Rick: Scheduling of the curriculum having Gus up first, with his framework that we were going to apply, and then seeing him apply it was very instructional for me, so that helped kind of reinforce the methodology. He is very good at incorporating, the combination of process competencies and content competencies. An example is that it's easy for me to generate learning objectives in a standard way. I had been lecturing for over 10 years before I met Gus and never once developed a learning objective. Ya know, I mean, the learning objective was the topic of the lecture, 'apoptosis and cancer' that was it. Now, everything I do I sit down and think about learning objectives before I even start putting something together. What do I want these students to walk away with? I think just that exercise alone, just applying that exercise, has made me a better teacher. Why has it made me a better teacher? I focus on the content, I think which I was always good at, it was never a problem knowing what to teach, but when I think on the process competencies (e.g. how to analyze data) then the presentation of the content completely changes for the better. Because if I really*

want them to generate a hypothesis, then how, what do I want them to use to do that? What I am going to use to help them practice that skill? How will I work the session so that they have an opportunity to work on their data interpretation skills? [Interview, 083112]

Faculty agreed that POGIL lacked flexibility. The method may not have been the best for small classes with a single group, even though the method recapitulates the scientific method. Even though participation roles are assigned in POGIL, the roles do not necessarily promote equal student participation. For example, if a student is in the manager role, they may not be as vocal in the class activity as the questioner or recorder, who may be asking questions and summarizing what was said. It is unclear to the instructors if the student manager understands the class activity in the same way as his or her peers. To address this concern, roles rotated from session to session and faculty often asked follow up questions of the small group to solicit understanding from all group members.

Even with adaptations and best attempts at implementing POGIL, Agatha expressed frustration in the instructional process:

Agatha: *Honestly, I don't think, I didn't think I felt happy with most of the classes I did. Um the low for me, was one of the early sessions where I was really trying to do a POGIL kind of thing. I was really trying to have them work through a problem, and, um. What I was trying to do was have them work through pieces in a kind of a scaffolded way of this article with guiding questions and to talk about it as a group and then you know have some kind of debrief at the end. But that wasn't what happened, I could see the students shut down, because ya know, they were supposed to be working on it, and other [faculty were] kind of jumping in, so I don't, I don't know that that particular, and this was very early on, I don't know that that session was very effective for the students because they were getting kind of a mixed message. I'd really intended the thing as the students working together and with us kind of observing and seeing what things the students were confused on and then at the end there would be a kind of discussion, but the idea of having them struggle with it a little bit first, and and with faculty jumping in, perfectly*

appropriately…I just felt it was important for the students to work with it a little and see where they could get before telling them or leading them the correct way [Interview, 091412].

Other facets of POGIL instruction that Agatha evaluated after it had been implemented included:

1. Debriefing using points of confusion or difference between groups, as did not initially occur because there was only a single group.

2. Use intended POGIL roles for students. The role assignments had to be adjusted—there was no sense in having a "reporter" if there was no group report out (due to #1).

3. Faculty did not facilitate the groups. There were 4 faculty and 4 students, and it was difficult for faculty to not jump in the beginning, I think this got better later. In a larger group implementation, the faculty guide would wander around, help students get unstuck, and facilitate the process part *[Memo, 112411]*.

   Agatha: *The POGIL method is built on the idea of "concept discovery" in sessions, but I think the way we have implemented it is more the reverse—they are assigned a review article as preparation, then dissect a research article on that general topic. It has been difficult to calibrate what level of concept discovery is do-able and appropriate---or is the "concept discovery" part really identifying the next questions or concepts to explore beyond the paper? [Memo, 112411]*

For Gus, evaluating his own teaching came from being attentive to the "mood in the room" [Interview, 082312]. The experience of teaching sessions and then being able to compare the vision to the reality provided him with a perspective on what was working. But he could immediately tell if students were engaged or his session was "good" by their mood. He described that he can look at the students and know if they are "getting it" if they aren't its time to go back and look at what he did or didn't do. [Memo, 092612]

2. *Content coverage.* Faculty engaged in discussion about the best way to develop students' research competencies through authentic course activities. Evaluation

of courses and curricular gaps began after the first few weeks. After the first eight weeks, faculty reviewed their collective experiences to identify gaps, and then proposed mechanisms or topics to address those gaps and give the students tools for autonomous learning. In the fourth graduate course, practice of translational science course (PTSC 4), the course was planned by Gus to provide such a model. This course would focus on one singular disease, atherosclerosis.

> Gus: *It's about tying it all together. An approach to learning about and Investigating new fields of inquiry to build knowledge by having a model to do it. From the anatomical to cellular level and back. [Memo, 031512]*

To attain this gross to cellular level of awareness in the research process, the final course included an examination of aortic specimens across various ages revealing the progression of atherosclerosis. The student palpated and examined the specimens as Gus orally quizzed them about the features and condition of the aortas. The oral questions related to the pre-class reading and required their recall of knowledge learned in the first medical school course, Gross Anatomy (6 months earlier). For example, students were asked to identify the location of plaques, obstructions, calcification, necrosis, and other vascular structures. Once the gross structure was examined, students were asked about what cellular causes of inflammation contributed to the rupture of a plaque or proliferation of the disease [Memo, 040412].

The course activity included coordination with Agatha's autopsy team and the arrival of patient cases. Students were "on-call". They would then assemble in the autopsy lab and engage in the process of extracting a tissue sample, preparing, and then

examining the sample [Memo, 040412]. They worked with medical residents in the autopsy experience.

While this activity may seem highly coordinated and planned, the first time faculty discussed it, the plan required a lot of reflection on how to coordinate the autopsy, notify students, learning outcomes, and organizational concerns about autopsy lab access [Memo, 040412]. In student interviews, three students reported that the autopsy experience was a highlight of the curriculum because a graduate student would not typically have this kind of opportunity [Graduate Student Interview, 081512, 082712, 082812]. This positive evaluation led the faculty to retain the model in year two.

3. *From critiques to progress.* For Rick, there was a progression in his self-awareness about his own teaching. In the first eight weeks, he appeared not to self-monitor his contributions to classroom discussions. The role of the community was to provide Rick with feedback that he was lecturing is sessions or interfering with another faculty members instruction.

For the second 8-week class, the community made a decision not to use Blackboard. In a later meeting that decision caused a problem for Rick and Agatha who had difficulty remembering what reading materials and assignments were sent to students [Memo, 110812]. Last, they were concerned that without some central repository of the session materials it would be a barrier to future teaching and collaboration, such as when they needed to teach another faculty member's session.

This instructional process repeated again on the next eight weeks of the program. It would continue into the next 16 weeks of the Spring 2012 semester, however, evidence

within the first eight weeks of the Spring semester suggests a shift in faculty perspectives. Agatha stated that after she implemented her PTSC course (first eight weeks of Spring):

> Agatha*: our learning through this program implementation is like gears on a clock, we're learning and so are the students, and its interconnected. In the beginning we had an idea of what it meant to implement this new program model however like a student we had this idealized novice conception of what it really meant [Memo, 072712]*.

Once faculty started to believe they were developing curricular implementation expertise, they experimented and extended their use of instructional methods.

Episode 1.4: "It's All About the Process": Experimentation and Extension of Instructional Methods. With a semester of experience developing and implementing the new courses, between January 10 and March 7, 2012, I observed faculty try new instructional approaches. This episode, experimentation and extension of instructional methods, is characterized by applying instructional methods used in the program to other graduate courses or implementing new instructional methods within the program. Gus made an effort to implement a challenge-based instructional method, Agatha implemented reciprocal teaching, and Rick adapted guided inquiry and program rubrics to two other graduate school courses in biology and mechanisms of cancer.

1***. Challenge-based learning.*** Gus was comfortable trying new methods and had a broad understanding of educational literature. I introduced him to some literature on challenge-based instruction (CBI), which follows a cycle of presenting problems or scenarios to students (Schwartz, Lin, Brophy, & Bransford, 1999).

In CBI, students solve an in-class challenge, present their solutions in small groups to their peers, answer questions about their solutions, and then complete a second,

more complex challenge. This second challenge requires additional research. Initial studies of CBI in biomedical engineering suggest that student groups taught across multiple modules using active CBI instructional methods were more innovative and efficient at problem-solving as compared to students taught the same modules using lecture-based methods (T. Martin, Rivale, & Diller, 2007).

Gus made an effort to interpret the cycle of CBI into a class. He designed one module but he struggled with its adaptation, defaulting to general lecture and discussion. In a meeting following his experimentation with CBI, he shared his perspective of the method with other faculty, suggesting it would help to have a demonstration of the method if used in the future.

2. ***Reciprocal teaching***. Agatha's instructional sessions most often followed the POGIL approach, but she also experimented with alternative instructional methods in the third PTSC course. She was interested in applying reciprocal teaching (Palincsar & Brown, 1984) to help students with scientific literature reading comprehension. In class, she introduced the method and used the four steps of summarizing, questioning, clarifying, and prediction to read a scientific article [Notes, 021812].

Agatha equated the tools learned through reciprocal teaching with the skills important to scientific communication. For example, she explained to the students that summarizing complex scientific studies in a short few sentences is not easy, even for experts. Summarizing is an important skill for conference presentations, writing, and dissemination of research to the public. She also emphasized the importance of asking good questions as researchers and practicing inquiry while reading scientific articles.

Clarifying terminology or methods that are not well understood can enhance scientific knowledge. As scientists, she explained, it is important to predict or hypothesize the next steps in a study. These skills will help student become critical consumers of scientific literature.

Agatha read and demonstrated the four steps to students, then worked with them on a section of an article. She then assigned them different sections working slowly through the paper on pollution and its potential role in accelerating inflammation and insulin resistance. Graduate students would later report it was a very impactful lesson, which altered the way they read research literature in the future [Graduate Student Interview 082712].

3. ***POGIL in other courses.*** While I did not directly observe Rick's experimentation with alternative instructional methods, in an offsite faculty meeting Rick reported his adoption of POGIL approaches to the faculty community. He explained that instead of telling students about the seminal technologies and discoveries in his biology course, he was going to have them construct a timeline and tell him about it [Memo, 030712]. He reported that he was going to ask students to identify some of the characteristics of why those discoveries were important and analyze the research questions of those earlier studies. This report by Rick was the first direct evidence that he was becoming more comfortable moving beyond purely lecture-based methods and trying new instructional approaches. This evidence is the first time Rick owned new teaching approaches, rather than reporting about them. This was important because Rick had taught through lecturing for ten years. At this time, he also reported that he would use

guided inquiry methods in in a cancer mechanisms course. By Fall semester 2012, Rick had used the POGIL approach in a second class and invited a medical faculty instructor to co-facilitate the class with him.

Episode 1.5: "Can You Imagine Any Other Way?": Appropriation of Instructional Philosophies. Appropriation of instructional philosophies is defined as the adoption of perspectives of teaching as one's own. A final reflection on the prior implementation year (August-September 2012), defined this episode. Rick who could not fathom teaching without lecturing completely adopted Gus' views about teaching:

> Rick: *Rather than seeing myself as just a provider of facts, which was really my approach up until that point, I changed my presentation of facts, to how could I really present this information in the appropriate context for self discovery, that's the key to me for authentic learning is self-discovery rather than, its not either or, its more weighted to self-discovery, than presentation of the facts by me, ok. So, so maybe the real answer to the question is it was my own self-discovery and Gus leading me to that discovery. That was when the light bulb went off, he was the guide, he was the guide, and essentially, what he did, he created the environment for me to accept that methodology and like I said, when I got it, I was like, yeah, this is absolutely it, it was hook line, and sinker, it was like 'what the hell was wrong with me?', and I became as anti-lecture as him [Interview, 083112]*.

During the start of the faculty meeting in the new year, Agatha sat down and began talking about what a bad professional example she had been in laboratory practicum that morning. She had several students from multiple PBL groups in the practicum group. She asked these students questions, but none of them would respond. After several attempts, she stopped speaking and addressed the group. She stated to the students "Look, you have all signed in for the lab, so I will give you credit, if you want to go. If you aren't going to participate in a discussion with me, let's not waste the time. I don't

know what you do or don't know unless you talk and ask me questions. I can't help you because I don't know what you know" [Notes, 011413].

She exclaimed this to the group, and Rick, who was also having difficulty getting students in one of his classes to participate, laughed and said, "Maybe I should try that!" Then Agatha said to Rick and Gus, "would this have bothered you four years ago?" Rick responded, "no", then asked Agatha and Gus for ideas about how to encourage group discussion in his classroom [Memo, 011413]. He also stated that students think they are learning through sitting in lecture, but when he quizzed his students on the content of his prior lecture they got the answers wrong. Agatha continued, "Student behavior drives faculty behavior, but these students are so used to faculty doing all the work, I don't know how to tell them 'this is no way to learn', look at all the opportunities you're missing". Students' learning was a cause for faculty reflections. The next section describes three types of episodes related to student learning that were a source for these reflections.

Theme 2: Community Reflections on Student Learning

This section, *Student Learning*, describes three kinds of episodes as triggers for community reflections on students' learning in the program. These three episodes are: (1) surfacing student prior knowledge as an expert, (2) the role of scientific dialogues, and (3) the effect of interpersonal relationships among students. It is important to note that these episodes do not reflect all incidents of when faculty discussed or were concerned with student learning, rather the question of "are students learning?", was a continuously asked one. These episodes represent a collection of community activities

that occurred in reaction to shared experiences in the classroom. At the end of each eight weeks when the grading spreadsheet was compiled for a course, the community collectively reviewed the grades and once again reflected on student learning.

Episode 2.1: "How do you know what they know?": Managing the Expert Blind Spot. In the first semester of the program, Agatha, Gus and I attended a Faculty Development Day. At the conference, a presenter was commenting on the research based principles for teaching (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2011). She presented a slide about developing one's awareness about their field and the formation of the expert blind spot (Nathan & Petrosino, 2003). The expert blind spot develops as one develops more expertise in their field. Experts become less aware of "the learning processes and instructional needs of novice students" and, unfortunately, "educators with such expertise often are entirely unaware of having such a blind spot" (Nathan & Petrosino, 2003, p. 906). The expert blind spot would become an explicit part of conversation between faculty after this conference experience. Yet, managing the expert blind spot was a persistent challenge.

Rick articulated an example of this expert blind spot

> *I could see when I planned out these questions for the unit (March 29); I hadn't thought about how hard it would be if you didn't have all this prior knowledge, to answer the questions (on cholesterol biosynthesis and familial hypercholesterolemia) some of the session didn't work so well. It required a lot more time than I expected, and we ran out of time on what I had planned. [Interview, 083112]*

What was interesting was that this was one of Rick's well-planned sessions and instead of acting as if it was improved over and above prior classes, he was critical about his instructional performance.

A student was tasked with presenting a grant idea and on another separate occasion, the same student taught a session on a hallmark of cancer, an area of Rick's expertise. Rick seemed to have difficulty not lecturing in the student grant presentation session. On both occasions, Rick interrupted the student with a series of questions, waiting for the other students in the room to respond. The first time, the student said nothing. Instead of recognizing the student's level of confusion or lack of prior knowledge as a problem in the situation, he stated that he was "surprised at how naïve the project was" [Memo, 110111].

The second time, which was 8 months later, Rick again interrupted the student with a series of probing questions, waiting for the other students in the room to respond. The student who was running the session explained, "Rick, you just helped them answer all the POGIL activities in this session". Rick's reply was "Oh, I did? Ok, I'll just shut up now" [Notes, 120412]. Gus also called out Rick's behavior in the meeting that week. "I thought you were commenting a little too much, that may have intimidated the students" [Memo, 120712]. Rick acknowledged that he thought he might have been talking too much. Rick was unaware of the effect of his behavior on the student in the first presentation situation, but over time he was able to regulate his scientific contributions.

> Rick: *The last year was a learning experience for me, that is why I participated in so many sessions, I just basically wanted to be there to see how it was done and how these things were going to unfold in the progression of the student advancing in their knowledge, where they were and where they are now in their learning. I have to say; you need to be engaged in how they're doing, I think there was an advantage for me along the way, growth of the students as well as my own growth in the process. Being in touch with their work and seeing how they are changing and progressing so that again, my approach [to teaching] can be modified to where they are as a group and as individuals. One group of students, recognizing that that was one set of personalities and that we could modify our approach as well and so now, to institutionalize these methodologies to a more diverse group of students right? They are different and they are similar and so I need to try to stay as engaged, but it will continue to be a balancing act [Interview 083112]*.

Episode 2.2: "Content Knowledge Doesn't Make You a Scientist": Difficult Scientific Dialogues. In this theme, personal experiences about learning science were shared among the faculty community Rick reflected on his postdoctoral training and how challenging his mentors were. Gus described learning to become a scientist on the job. Simulating these personal training experiences for the students through intentional activities that helped them develop the competencies of a scientist was a goal of the program but derived from reflection on experience.

Rick reflected that after the PTSC course it was "dissatisfying to just teach content, you can't teach the competencies of a scientist that way" [Memo 033012]. His basis for this was his own experience.

> Rick: *I didn't really blossom as a scientist until the end of my second postdoc, it was at the [National Institutes of Health] that I was challenged. I had three mentors, the lab that I was in, we had the what we called the 'super lab meeting' every month and those mentors were very critical of the postdocs, in a constructive way, you know, challenged us to think like scientists. 'Don't tell me what experiment you did, ok, tell me why you did that experiment.' Then challenged us to look at it in the context of the project and determine if that was the experiment to do or not to do, or what. It was treated like a peer-review, about the science, not about me as a person, but the work. Sometimes it was that stark*

and cold, and I am not saying that is the formula that needs to be applied, ok, but when I self-reflect on my own experience and compared it what Gus what saying, I could see that it was a better way, ok, in fact, you could bring those things that helped me to learn later in my career way up front and start challenging students right away, and I started to identify weaknesses in my own graduate students, ok [Interview 083112].

Students were required to present milestones in their grant writing projects. These milestones were sections of a full grant proposal. Students worked on them separately, presenting their work when each part was complete. During these presentations, faculty asked questions. Rick was getting a reputation by students as the tough audience member, challenging their research arguments [Graduate Student Interview, 082812].

A "Mock" study section was another course activity and assignment. The mock study section simulated a panel reviewing a grant application at the National Institutes of Health (NIH). Like Rick's own experiences at the NIH, faculty modeled the Mock study section as if it was a "peer jury" asking students to answer tough questions about their grant application [Memo, 032712].

Rick: *You could present somebody something like, today, the molecular and biological basis of angiogenesis and you could, while there was a mini-lecture [for background introduction] you could see the students really get engaged when they started looking at the data. I could have given them a paper [that they had to read] and said, let's go through this paper, ok, and they would look at those figures [the data] and say what the authors said about it because they had already read the paper, ok, which is really the lecture format, but instead I presented the data to them as a scientist in the laboratory, as if they had done it [the experiment] themselves and got the result. They see the outcome and now they have to interpret it. They need to know certain background information ok, like what is CD31 and why its pink and why its green ok but the exciting part came when they started to "get" what the results mean, that's what scientists do in the laboratory, that's what experimental science is all about. And that is what authentic learning is and I just didn't appreciate how exciting authentic learning*

> *could be. But then, I realized, for me, that's why I got into science and stayed in science that's what got me excited about it, I didn't stay in science because of what they taught me in the lecture hall at [XX] University, I stayed in science because I was in a lab with investigators working at the cutting edge of science and I got hooked on the excitement of doing the job…doing an experiment, discovering something new and interpreting the results and realizing you discovered something new. Designing the next experiment and advancing your knowledge and Gus totally convinced me this way the way to teach and now, I am absolutely convinced, I drank the Kool Aid. [Interview, 083112]*

Gus also described his own experience in training for his PhD. He disliked lecture because he felt that everything he learned about being a scientist came from the practice of the job [Interview, 082312]. For example, how to manage grants, recruit and manage research personnel, work in teams with others, teach and make presentations.

Episode 2.3: Student Affairs: Mediating Interpersonal Relationships

In this theme, faculty reflected on two issues that occurred during the implementation that created a potential disruption to students' learning and working together. These two issues were: a student interpersonal conflict and a student withdrawing from the program [Memos, 032912; 062912; 070212; Notes, 100411; 032812]. In each case, the events required faculty to reevaluate their recruitment practices, rigor of the program, and student professionalism practices, and university resources.

A student indicated to faculty members that she concerned about an interpersonal conflict that had developed between two other students. While the actual facts of the interpersonal conflict were never clear, one of the students had a strong emotional reaction to two other students. The names of students and more details about the incident are omitted from this section in favor of maintaining participant privacy.

The interpersonal conflict between the two students was unknown to faculty and was brought to Rick's attention when it had finally escalated off campus one weekend. Separately students had requested meetings with different faculty. In the weekly meeting, the student issue took an entire 2-hour meeting discussion. During the meeting, faculty presented the various versions of the conflict as reported separately to them by the students. Following this discussion, they reflected on their options including: (1) contact student health services, (2) review the issue with the Dean, (3) independently conduct a further investigation and (4) follow up interviews with other students as appropriate.

As a community, the faculty members came to consensus on an individual and a collective plan of action and follow up. Faculty followed through on all the actions they listed, assigning each other to the actions given their role in the community or university. For example, Rick as the Program Director, reviewed the issue with the Dean and contacted student health services, and Agatha and Gus interviewed more students.

Students initially tried to conceal the interpersonal conflict between the two students in classroom interactions, however, when faculty reflected on the matter they reported evidence of a decline in academic performance by a top student and decreased enthusiasm for group learning activities [Memos, 062912; 070212]. As a result of this, faculty assigned advisors to students from the start of the program. In the future, the advisor would be a main point of contact for students as they transitioned to graduate school. Faculty advisors could anticipate interpersonal issues or general adjustment difficulties and intervene with support services, before there was a detrimental effect on academic performance.

While this summary is brief, the students' interpersonal conflict was a matter that spanned more than three months of time from first being brought to faculty members' attention to its resolution [Notes, March 2012-July 2012]. As a result of the situation, faculty decided they needed a guide for student advising, a professionalism statement that could be provided to students at program orientation, and sought out a checklist for determining when a student health services referral was necessary [Memo, 070212].

A second student affairs issue arose around the same time of the student interpersonal conflict. A student began missing class and unexpectedly requested a leave of absence. While the student described it as a personal problem, she ultimately decided to not pursue a PhD. The student decided to withdraw from school. This issue was a critical incident in the community. Faculty reflected on this issue over several meetings and individually met with the student.

Faculty attributed the student withdrawal to a collective recruitment decision-making error and curricular adjustments that faculty made as the courses were implemented. Faculty had reservations in August about the student's prior scientific knowledge and discussed this as a potential weakness for success in the medical school courses. In fact, the medical school courses were not the problem, possibly due to their highly structured format. Faculty reflected that the potential issue was the discussion-based format of the graduate school classes, the essay style examinations, and the grant-writing component [Notes, 040612]. These were assignments that required articulating scientific understanding and critical thinking. The student struggled with these assignments particularly in the third PTSC course.

Faculty determined a second factor could have been the newness of the curriculum. Adjustments were made to the syllabus during the semester when faculty received feedback from students that the medical school courses were overwhelming [Notes, 100411]. For example, a test date or assignment due date in the PTSC course was adjusted in consultation with students. Faculty believed that, over time, these adjustments might have had an adverse effect on this particular student [Memo, 032812; 032912].

Theme 3: Community Reflections on Assessment and Evaluation

Overall, the community engaged in joint assessment and grading practices, such as each faculty contributing examination items from their sessions or area of expertise covered in the course, collective discussion and approval of final course grades, observations and rubric completion on presentations and grant milestones, and discussion of student challenges. This section, *Assessment and Evaluation*, describes three major episodes that occurred on the theme of program, course, class, and student assessment. These three episodes are: (1) rubric development, (2) determining the fair and appropriate grading practices (e.g. medical school versus graduate school scales), and (3) approaches to student assessment. Assessment and evaluation accounted for 20% of the agenda topics.

Episode 3.1: "We need another rubric": Authentic versus Standardized Assessment. Student performance was an important concern of the community in meeting discussions from the second week of the program forward. Assessment occurred on 10% of the agenda items. Because of the competency-driven focus of the curriculum,

faculty had a philosophy that included an initial objection to using multiple choice questions tests (Agatha, Gus). Rick did not voice his position on the topic decisively. He did "mock" the measurement of performance through rubrics. When discussions turned to performance assessment, he declared sarcastically, "I know! We need another rubric!" [Memo, 121711]. Yet, he adapted rubrics to his other cancer mechanisms class [Memo 012012].

In the first weeks of class, faculty realized that during class students weren't completing the reading for the entire session. In addition to circulating a rubric to observing faculty for the purpose of rating classroom participation, faculty also introduced the 5-10 question multiple choice question and short answer quiz for assessing reading comprehension of articles. The quiz was administered at the start of class.

Table 6.3

Types of Community Developed Rubrics and Assessments

Rubric/Assessment Type	Purpose
Class Participation	Measure Contributions during POGIL and PBL activities
Oral Presentations	Rate students on skills for scientific presentations
Written Grant Documents	Measure effectiveness of writing on each grant component
Peer and Group project Assessment Form	Student completed rubric for group grant writing
Teaching Skills	Assess students using various instructional methods to teach 1st year students hallmarks of cancer.
3 Essay-based Written Exams	Assess application and synthesis of readings to hypothesize new studies and interpret data.
Weekly Pre-Course Quizzes	Assess reading comprehension; low stakes, reviewed in class

Episode 3.2: Determining the Grade

In this episode, faculty spent time reflecting on two grading issues. These two grading issues were: the type of grading scales in the program and the collective creation

of student essay-style examinations. Since the program required student to take courses within the medical school and the graduate school, the grading scales and approaches are different. Faculty repeatedly discussed the grading issue in meetings during the program implementation.

1. Grading scales. There were two potential grading scales for the program. One was the scale used in the medical school where 85% and above, was equivalent to an "A" and then the graduate school scale where 90% and above was an "A". The key issue for faculty with the grading basis problem was that faculty wanted to reward graduate students for scientific thinking skills in activities, not based on the recall of scientific facts.

The way the program addressed the difference in the graduate students taking medical school courses was through weighting test scores differently than for medical students and increasing the weight of the teamwork components and in-class inquiry assignments for the graduate students. All the grading components of the medical school course were the same for both medical and graduate students; the final grade was determined by weighting each component differently. This grading difference was important when graduate students first test scores in medical school courses were lower than the medical students.

Concurrent with this performance difference, students begin to express feeling overwhelmed and underprepared for the medical school component of the curriculum [Memo, 100711]. Faculty reflected on the impact of making adjustments to the curriculum. Grade-weighting differences were discussed to determine if additional

changes to the grading basis were needed. Further, faculty had different ideas about which scale, the graduate school scale or the medical school scale, would be used for final grades. A decision was made to use the medical school cut off of 85% to determine an 'A' grade for the graduate students. The grading basis would be reconsidered in the start second year when a student had challenges with the medical school course exam. After applying the weighting formula with the emphasis on active learning assignments and scientific discussion activities, the student passed the course.

2. Student examinations. Each faculty member contributed to the development of and the grading of the end of course examinations. Two weeks prior to the end of a Practice of Translational Science Courses, faculty reviewed the instructional modules they were responsible for teaching. The director of the course (i.e. Gus, PTSC 1; Rick, PTSC 2; Agatha, PTSC 3; Gus, PTSC 4) created two or three examination questions. The other faculty each contributed one question. The test was compiled by me and sent to everyone for review. The faculty reviewed the compiled essay-format test. The course examinations were written in essay format to test synthesis and application of subject matter. Students were required to interpret graphs, apply scientific thinking and generate hypotheses and critique excerpts from studies.

Via email, faculty determined the test questions that students had to answer and those other questions that were optional. For example, the test included 6 items. The students were required to answer the same 3 questions, and then choose two of the remaining questions to answer. A sample of the type of test that was developed by the community is in Appendix G. Given that each faculty member taught different modules

in the curriculum and had different expertise, the tests were divided up and each faculty graded their questions (s) on a 100-point scale. Depending on the difficulty level of a single question, faculty discussed if the items should be weighted more heavily than the others. A final test score was computed.

At the end of each PTSC course, the course director compiled a spreadsheet of all the students' assignments, exam grades and grant project presentation grades. The spreadsheet was collaboratively reviewed and discussed in faculty meetings. Then the grades were finalized and submitted to the graduate school.

Episode 3.3: "Do They Know Enough Structure and Function?": Assessing Student Progress.

In this episode, faculty deliberated the gaps in the curriculum and how these gaps were revealed through two particular events, student grant projects and a year-end wrap-up meeting where they reflected on student's progress in the curriculum.

1. Grants project. Faculty made a curricular misstep in November 2011 in the assessment of the first student group grant project. The misstep, however, resulted in revised community procedures for developing and assessing assignments. The student grants project required 4 graduate students to work together to create a written grant proposal in response to a current National Institutes of Health (NIH) funding opportunity announcement (FOA). The students selected an announcement on the Epstein-Barr virus (EBV). The student proposal aimed to address the link between Epstein-Barr virus (EBV) and a rare form of cancer, nasopharyngeal carcinoma. Students submitted the specific aims of the grant project to faculty. After the students submitted the proposal, the

next class session included a student presentation and discussion section. Three faculty members were in attendance. One faculty member stood and lectured about the scientific basis for the argument, dissecting the links proposed. Immediately after the session, one student expressed disappointment in the way the class session unfolded.

> Student: *I was so upset about today's session. I had written everything except for one part. So it was a little difficult to hear from 3 different directions that the writing itself was poor with literally nothing positive to balance it [Memo, 112911]*.

The student felt that the critique of the assignment was harsh, especially for novices who were just learning how to write grants. Faculty later acknowledged that the manner in which the assessment of the grant project unfolded in class was negative. In class faculty were quiet, as they did not know how to intervene in a way that would not show disagreement in front of students.

In response to the student feedback, Agatha proposed that faculty needed to get together as a group and decide how they would handle structuring classroom feedback [Memo, 112911]. She also proposed that they communicate about ideas for class sessions and assignments to each other in advance:

> Agatha: *We should debrief this [grant session and feedback process] together at some point. I think it would be really useful to run ideas about each session by the group—everyone's suggestions are useful, and it would help us avoid disagreeing in front of the students. Maybe add this to the meeting agenda? [Memo, 112911]*.

2. Physiology Structure and Function. At the beginning of the second program implementation year, one faculty meeting discussion centered on ways in which they could improve the physiology coverage in the program [Memo 090712]. Following

student grant presentations, Rick was concerned that students were still lacking a full appreciation for the scope of the function and structure of anatomy. The faculty talked about asking students to incorporate some discussion of relevant physiology connected to their individual grant assignment. The grant presentations revealed that students did not include the systemic physiology related to their projects, for example, the relationship between the heart, kidney, and lungs.

Faculty spent 2 hours debating "Does it matter to the curriculum that our students won't be recognized as experts in physiology or pathophysiology? How much structure and function knowledge is enough?" To address this question, faculty revisited the syllabi for the first two courses, PTSC 1 and PTSC 2, which had covered some physiology topics. Two possible options were explored, taking a class in the Year 2 medical school curriculum or an online video simulation. Agatha tried "to find some cardiovascular physiology simulations, which ended up being dense and hard to weave into instruction" [Member checking communication, 031913].

Faculty queried each other about whether they missed an opportunity in the first year of the curriculum to integrate more physiology. They reflected on this issue through asking one another the following questions:

1) Do we pose as a question of pre-clinical animal model (for the translational connect) or have them expand on the physiological implications and systems connection and interactions?
2) Do we have them prepare a presentation about the connections and physiology to justify the rigor of their pre-clinical model? How representative is it of the disease you are addressing?
3) Do they have to do comparative physiology understanding…is host response the same in an animal versus human…what is impact overall on the animal

and its disease relevance to humans? Do they see the organism as a model and not as a procedure?

4) We should focus on the model. The translational nature and then justify the model as broadly as you can…go deeper into the model and explain what the limitations of the model are. What is normal? What would you do? [Memo, 090712]

One of the options offered was to try giving a challenge to the students to see what they can do (e.g. using their existing skills). Agatha stood and diagrammed the options on a white board across each of the courses, indicating what could be changed in the project activities to include more physiology. Ultimately, faculty did not make a decision and take additional action with the students to address this perceived curricular weakness.

Theme 4: Community Reflections on Organizational and Leadership Development

This section, *Organizational Leadership and Program Management*, describes three major episodes, or activities, which occurred in this theme. These three episodes are: (1) the effect of organizational structure and politics on goals, (2) the impact of funding, and (3) envisioning the future. This theme provides the larger context for the work of faculty, even though a few examples of evidence of its influence are provided here.

Episode 4.1: Let's Talk Politics: Negotiating Organizational Structures and Roles. All the faculty concurred in their interviews that they made at least three critical organizational decisions that contributed to the strength and success of the program to date: its unique cross-institutional structure, its interprofessional design, and including a team member with an educational background (e.g. the researcher).

Before the program could become a reality, the cooperation of leadership across the institution was necessary. Agatha describes her initial approach to finding a home for the program:

> Agatha: *I felt duty-bound to involve Ling since I am in pathology and she had a pathology department program. I just, I wanted to see the lay of the land and where it would live, but it became clear at that meeting that Ling was not interested in participating in something like that in terms of the pathology graduate program and also that she wasn't in anyway going to stop us from doing something separate. So, I think at that point [we] started [Interview, 091412].*

Rick recalled articulating and "selling the idea" to the School of Medicine, where this kind of interprofessional and competency-driven program was not the norm and negotiating the establishment of the revised program with the graduate school.

Across the program implementation, faculty encountered organizational hierarchies and relationships that required exploration and discussion regarding their impact to the program and its future. In another instance, students were registered for too many credit hours. This required a sensitive negotiation with the Dean of the Graduate School to remedy how this could be (a) paid for since students were on school stipends and (b) how it would be reflected on a students transcript. This was a politically sensitive conversation since Gus stated "he would have gone in with a completely confrontational attitude" but Rick handled the situation in a more respectful way. When he shared this with Gus, Gus admitted later, [Memo, 042012] that he really respected how Rick handled it and learned from that experience.

Episode 4.2: Using the "F" word: It's All About Funding.

On the weekly meeting agenda funding topics appeared 11 times as a specific agenda item (Table 6.4). Data revealed that funding discussions arose at meetings in relation to the future of the program, the national budgetary fiscal crisis and NIH funding, mentoring support for dissertations, recruitment of graduate students, student research poster awards, medical student summer research stipends, administrative operations, conference travel, and instructional materials and technology.

Faculty reflections on funding problems or opportunities centered on three types: program seed funding (e.g. Howard Hughes Medical Institute; HHMI), student support and mentoring (e.g. NIH grants, private grants, institutional support), and educational activities, support, or institutional resources (e.g. instruction, recruitment costs, conference travel, and educational dissemination). Rick, Gus, and Chip held funded research grants and mentored some students and postdoctoral fellows at the university. Funding discussions were primarily driven or led by Rick or Gus. Training students in grant writing skills to obtain funding was a component of instruction. Funding was also an issue related to judging faculty performance.

1. Program Seed Funding. As revealed through faculty interviews (Rick, Agatha, Gus), the topic of funding for the program was one of the catalysts for the project. Rick described funding opportunity through the Howard Hughes Medical Institute Med into Grad Program (HHMI) as the "motivation to at least get down on paper in an initial outline the plan for the program" [Interview 061912].

Table 6.4.

Types of Funding as a Topic of Community Discussions.

Topic	Dates	Type of Funding
Howard Hughes Medical Institute (HHMI) Request for Proposal	Pre-program	Private; External
Educational innovation grant; student funding; curricular implementation	09-12-2011	Private; External
Student stipend funding	09-26-2011	Federal and Private; External
Brainstormed funding sources	11-21-2011	All
Brainstormed funding targets	12-14-2011	All
Institutional Budget planning	03-02-2012	Institutional; Internal
Faculty Teaching funds	04-17-2012	Institutional; Internal
American Association of Medical Colleges (AAMC) Educational Innovation Award	08-15-2012	Public; External
Academy of Teaching Award	08-03-2012	Institutional; Internal
University Regents Award	11-16-2012	Institutional; External
University System Innovative Teaching Award	10-19-2012	Institutional; External

Gus participated in the writing of the HHMI grant with the team, initially bringing it to the attention of Agatha. Agatha talked about initial program funding in this way:

> Agatha: *Gus saw the RFA for this HHMI med to grad program and emailed me and said 'is this something relevant for us' [in another program]. I said, immediately, in my mind thought of Rick, because he is working on something like this… We looked for salary support from the grant because of time investment of faculty time, you know, that was expected. So by the time the thing didn't get funded, Rick said, 'you know, I've promised these people that we're going to start admitting students', so we don't have an option, we need to go ahead, and so um, we we, proceeded to set up, ya know, phhh, ya know, weekly meetings to try and get the curriculum outlined. [Interview, 091412].*

2. Student Support and Mentoring. Biomedical education and training requires student mentoring and stipend support for a significant portion of graduate student training and education. Federal funding such as fellowships, traineeships, and research grant support comprise the majority of financial support, where trainees are supported

through laboratory funding in which students work and continue training. Another funding type is an institutional stipend, usually a graduate teaching or research assistants' annual salary. In the program in this study, the institutional stipend is limited to one year. After the initial year, trainees will secure a research laboratory placement where they will remain for the next several years completing research projects leading to the dissertation defense. The primary investigator in a federally or privately funded research laboratory is responsible for the salary and tuition support of this trainee after the first program year.

Faculty reflected on student funding support opportunities in particular in the spring semester. Students were beginning rotations and were half way through the program. As students completed their first year, faculty felt a sense of urgency about what to do if funding was not available for a student's second year. Government training grants, often called T32 grants, are federally funded stipends that support student research. Rick spent about 90 minutes educating faculty on the training grant application process of the NIH for a T32 training grant and its relevance to the program [Memo 081012].

Faculty engaged in discussion about T32 funding again when National Institutes of Health Research Report on the Biomedical Workforce predicted reduced federal funding support (Advisory Committee to the NIH Director, 2012). They were concerned that future students would face greater funding challenges as they competed for dissertation laboratories.

Faculty discussed their own experiences surrounding grant writing and funding awards in both their training and in their present research. They designed course

assessments and student presentations on grant writing to inculcate the importance of funding into the graduate students' training**.** Faculty developed two rubrics to assess students on their grant writing documents and oral grant presentations (See Episode 3.1; Table 6.3).

All faculty members participated in student grant-writing project from development to grading. The project spanned all the PTSC courses across the first year of the curriculum, regardless of the faculty leading the specific PTSC course. Weekly faculty meetings required decision-making on the project and students' progress. Rick developed a grant writing flow chart with examples from his own research to share with faculty (Appendix F). The purpose was to aid the community in teaching about effective grant proposal creation. The grant flow chart included sections required within an NIH grant format: significance, gaps, central hypothesis, Aim 1 and Aim 2.

Following the first year of the program, the program was recognized the American Association for Medical Colleges (AAMC, 2012) for research education and training innovation award [Award date, 092112], which helped elevate the program's methods, curricular design, and faculty credibility within the institution. Faculty discussed that while the award was only five hundred dollars, putting the grant together and obtaining it was worth a lot of "political" capital [Memo, 092412].

Rick described two collaborative funding models for student mentorship that included graduate school resources, clinical enterprise support, and the Translational Research Institute support. After hearing a story on public radio, he presented a crowd-source funding model that would use the Internet to raise money for the program

independent of any federal funding sources or private foundation. At the time of this paper, he had not yet secured additional training grant funding to support students.

Funding discussions would the community discussions, as faculty performance was judged by successful grant funding attainment. Work in the community slowed considerably prior to grant deadlines of a faculty member (Gus and Rick). Generally during these weeks, the faculty member whose grant was due did not attend the weekly meeting for that week. Other members of the community supported and respected the pressure that funding applications exerted on a colleague's teaching time by volunteering to cover PTSC sessions or facilitating the medical school course PBL session.

Episode 4.3: Envisioning the Future: Institutionalizing Program Practices. Faculty identified several curricular evaluation questions at the start of the curriculum. These questions were restated during the mid-year debriefing session. Faculty were interested in understanding the leadership implications of implementing a new curriculum. These leadership implications included:

1. Faculty time commitment metrics.
2. Changes in their approaches to teaching or shifts in their faculty roles.
3. Student feedback about program experiences, training quality and the use of inquiry-based instructional methods.
4. Interprofessional impact of the program.

The evaluation of data in response to these questions continues, although the time commitment was already captured in Theme 1. By the time the program had been fully implemented, they acknowledged in the member-checking session that they hoped this

research paper would really convey how much they learned as a community. To indicate how interdependent the community was on its members, in the ethnographic interview, each of the faculty members was asked what would happen to the program, should one of the members move on to another institution or decide not to participate?

> Agatha: *Any particular member you mean? Well, um. The first an obvious thing that would happen would be that it would obviously increase the workload on the other two, three remaining members of the team. I just don't think it is sustainable, I just don't think its sustainable. I've been worried about that for a long time. I worry about Rick's being able to sustain it for a number of reasons and Gus is more junior and needs to show some research productivity, although I am sure that this will benefit him academically, I think that everyone recognizes that he is a real talented educator. Um, and you know I have kind of thought about that a little because there have been times where like I already said that, I thought that I should just step back and step aside, I don't have much to offer, I don't, ya know that's just my own self confidence thing talking kind of but I don't think the team could function without me either, I mean, I think, I feel like my function right now my role is morphing a little and what I need to focus on right now I more the [medical students] and what kinds of competencies, what do we want the students to look like at the end and think backwards from there and how can I advocate for the [medical] students? It's easy for us to forget about them, I think, after the PBL courses because we are so focused on the graduate students and I want to make sure to do that. So if one of us were not there, if we lost a team member, it would affect morale, it would affect the work, I think it would affect the product, it would be like, I don't know, I can't be more specific than that, I don't know, I am just saying, I am afraid I think the program right now is a newborn and the team needs to nurture it. And if the team wasn't able to nurture it, I don't know who would be [Interview, 091412].*

Institutionalizing the program was a concern for Rick. Because he believed the program was the people and personalities who were involved in it, he felt like Agatha that the program was an infant and needed continued nurturing. While there were efforts from six months into the program and beyond to recruit new faculty, Chip was the only faculty member to whom they entrusted teaching a course. The tight community relationships and success of the program to date resulted in a reluctance to "let go" of the

program, for somehow it would corrupt the working relationships, yet the burden of the workload was ever-present.

> Rick: *Right now, it would be devastating, plain and simple. I mean all four of us, anyone, it would be devastating at this point. It's too infantile, were making good strides but it could go either way, nothing has been institutionalized yet. If the core falls apart, if the core falls apart, the whole program falls apart as far as I am concerned. That's the precarious situation that we are n and that's why we need to think about the longevity of the program and how we work to institutionalize it. Without compromising our goals, not only our goals but also our convictions. It's built on a specific philosophy and personalities right now. There are very few people on this campus right now, that I could sit in a room with for two hours and work out some of the issues we worked out last Friday, that would remain as engaged as they were, I am talking about at all levels, scientific or other, people in this program are really committed, beyond the fact that we like each other, really, I really appreciate the fact that people stay in a room and listen to someone's argument or ideas and staying focused on it [infusing more physiology in the curriculum and how do you measure that] an keep on working at it you know. Built on personalities, which is not the best scenario for longevity [Interview, 083112].*

Rick stated, "the reason for its success is the championing" [Memo, missing date]. He continued, that is would be very important to the future of the program to identify faculty who believe in the program philosophy in order to maintain consistency in how the instructional processes of the program were implemented. Rick explained his vision of the future:

> *Rick: I always did dream big with the program that it would have institutional impact, and maybe beyond the institution, and I still believe that, I still believe it can do that. We can establish and educational office in the graduate school, where we can modify graduate education they way the School of Medicine modified medical education. And the education office in the graduate school and medical school will work together to make it better for everybody [Interview, 083112].*

Theme 5: Individual Career or Professional Enhancement

This last theme includes what faculty may have learned individually as a result of membership in the community. Data reveal that the emphasis of an individual faculty member's learning differed across three areas. Rick's pedagogical skills and ability to self-regulate during instruction changed over time; Gus' enhanced his leadership and pedagogical skills, and formed new research collaborations. Agatha learned science and thwarted career burnout.

Episode 5.1 "Clicking Intellectually" .

> Agatha: *So I think at that point Rick, Gus, and I started working on ideas for it and started putting together things this HHMI grant, which, and everything. So um, writing the grant I think was really fun, I mean what I, what I, I had envisioned my role being is kind of a liaison with the medical part, since at that time I didn't have an active research program, and wasn't really involved in directly mentoring graduate students in the lab. Um but as we wrote it it just seemed like that kind of established um not only in some ways our roles and interests and expertise, but just kind of I guess ah, in some was a, ah, common ground, or a mutual respect or something and it was very easy to work together. [Interview, 091412]*.

Agatha described feeling like the loss of her research lab after a natural disaster meant that she had to let go of the vision of herself as an NIH funded investigator [Interview, 091412]. Through community membership, not only did she learn so much science, but also felt that the community validated her expertise, respected and valued her contributions, helped inspire her, and share her scientific beliefs, her convictions about the scientific process and values towards inquiry and the importance of questions in teaching [Interview, 091412].

She believed that burnout was a "very real thing" and this program energized her career. She explained the challenge of working with others on something new, but within the constraints of a very well established university system, "I don't think people really appreciate how hard that is to do" [Memo, 091612]. By the end of the program, Agatha stated that she was considering new educational routes for her career and as a result of her experience in the program [Member checking, 021713]. This included dissemination and educational scholarship, as well as continuing education in public health.

For Gus, he found new collaborations on campus, learned political relationship management and leadership from Rick, and practiced his teaching skills.

Episode 5.2: "I Learned So Much Science". This episode was characterized by not only learning biomedical science, but also educational science and about experimental design. Agatha stated that, "Every time I prepared for a session, I learned so much new science just reading and selecting instructional materials" [Interview, 091412]. Rick stated, "I learned something new almost every time I attended a student session, since Agatha and Gus have very different expertise from my own" [Memo, 091212].

Gus sent out science education articles or chapters, for example an article on metacognition in science education, research on students learning competencies of scientific research from research group participation, a research ethics article, and the experimental design chapters. Sometimes these scholarly articles were discussed within the meeting; for example, Gus assigned the experimental design reading to students in the

first PTSC course. As students received the experimental design chapters, so did the other faculty.

Watching peers present their own work and observing Gus or Rick's instructional sessions, helped Agatha realize the depth of their knowledge in their area of expertise. "What really impressed me was seeing Rick and Chris [his surgeon colleague] present to the students. Even after ten years of working together in collaboration, the depth of the problems they struggle with in designing the research questions, the limits of what they are allowed to do scientifically. It really speaks to the complexity of the [scientific] problems and why translational science is important" [Memo, 092912]. More recently, in the member-checking session, faculty stated that the teaching in the program has "definitely changed the way they view the contributions of their own research". Rick explained that he has changed his research focus, **"**I've changed my research focus from basic signaling mechanisms to the identification of novel therapeutics and animal models of human disease " [Memo, 021713].

Episode 5.3: The Scholarship of Teaching

The scholarship of teaching may be defined as "the intellectual, practical and critical work done by college and university teachers; that is, aimed at pursuing significant educational goals" (Kreber, 2005, p. 393). The program philosophy and emphasis on innovating the way graduate education demonstrated a commitment to advancing the educational goals of biomedical science training. In general, faculty were interested in using evidenced-based educational practices. This interest was eventually clear in their desire to be involved in the educational publication of their work and other

educational scholarship.

For example, Rick wanted to study student attitudes towards small group work in classrooms [Memo, 010412]. A lot of what Agatha thought intuitively about teaching she validated through reading educational articles, in particular on interprofessional education and the role of questioning during learning [Interview, 091412]. Agatha completed a study about the differences in problem-based learning issues and questions generated by interprofessional student groups versus medical only students groups [Memo, 031912]. Her abstract was accepted to an international medical educators conference. Faculty also applied for an educational technology grant to support concept-mapping software purchase for students [Memo, 081012].

Negative Case Analysis

To this point it is likely obvious that very little evidence has been presented about Chip, the faculty member who was recruited into the community six months into the program implementation to teach a course in the summer section on research design. Chip's is a negative case example against which the outcomes of full participation in the community may be compared. Chip had significant experience teaching in lecture-based formats and his prior engagement in structured faculty development programs is unknown. Chip was not a consistent participant in faculty weekly meetings. Chip attended approximately 5 meetings between January 2012- May 2012. He also met independently with Agatha to plan the instructional modules in the summer course. I was aware of two of these meetings but did not attend. Chip did not observe other faculty teach using the POGIL method and was not a PBL facilitator.

Two months after the research course concluded, Chip reduced his work schedule. When Chip returned to work in the late Fall of 2012, we met for an informal conversation to debrief the summer course and plan for the following year [Memo 120712]. In this conversation, he reflected on the course and what he wanted to change. These areas included the level of student involvement and the ability of students to analyze real data from a laboratory on campus [Memo 120712]. Agatha reported to me that she had suggested to him that we consider a more active and inquiry-based method to which the students were accustomed [Memo, 120912]. Chip did not agree or disagree, rather, attributed problems with the course as due to students' non-participation or other components of the course that were not affiliated with the teaching. For example, each week there were guest speakers planned [Memo, 042712]. Some were not well-received by students and Chip felt that in some cases the problem of the talks was that the speakers were not very good or the topic was unrelated to the topic of class lecture that day [Memo, 120712].

Students reported the class moved too slow, other reported redundancies in the statistic concepts [End of course evaluation, 062412]. Several students reported they did not understand the statistics concepts and felt behind [End of course evaluation, 062412; Graduate student interviews, 082312, 082812]. Chip did not check for student understanding rather, used questions without pausing to let students answer, and then would answer the questions himself [Notes in class file, undated]. The benefits that Rick described and were observed in improving his teaching and instructional philosophies were not realized for Chip during the time he taught research design and interacted with

the community. I speculate that if Chip had more time observing peers' teaching, receiving regular feedback from colleagues through more regular involvement with the community, it may have influenced his teaching development.

Interestingly, in a focus group with medical students a year later, they described the statistics course as one of the enduring experiences of their first year [Medical students' focus group, 012413]. What made it enduring was that they did learn about teamwork, learning about the complexity of the grant application process through the class research project, and how to consume research literature ahead of their medical school peers who did not have the course [Medical students focus group, 012413].

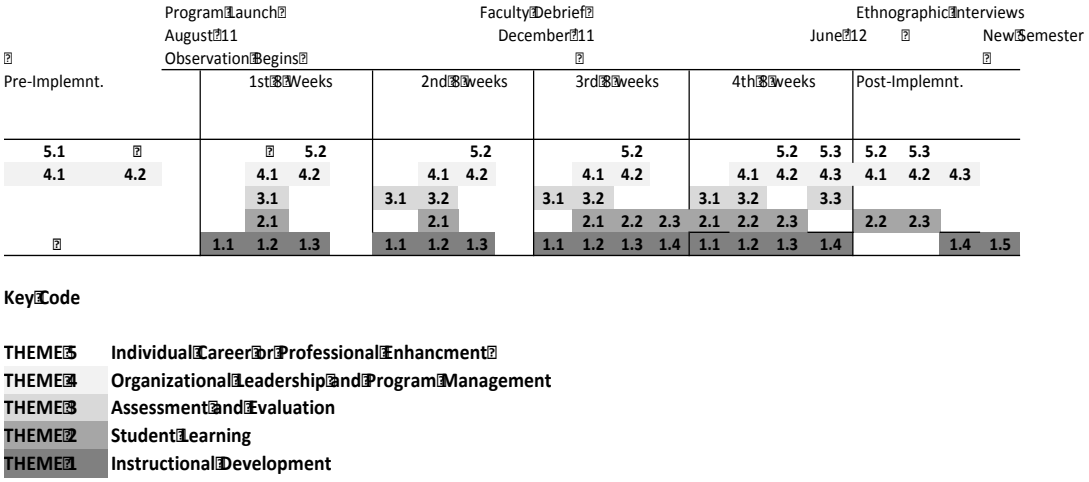
Longitudinal Episodic Timeline

The order in which episodes occurred naturally within the program implementation is visually depicted in Figure 6.1. Aligned with classes, the timeline is segmented by each 8-week component of the implementation year. Dates and milestones in the research study are labeled across the top of the timeline. This section will summarize the natural progression of episodes across the implementation period.

Fall semester, First eight weeks.

Consistent with the faculty development literature in Chapter 3, instruction (Theme 1) was the dominant activity of the community and was the foundation in the first eight weeks of the curriculum implementation.

Figure 6.1 *Longitudinal Episodic Timeline*



During this time, faculty were primarily concerned with instructional development, planning, implementing, and evaluating coursework and calibrating instruction against the learning objectives (Episodes 1.1, 1.2, 1.3; 2.1). Calibrating instruction was in the form of reflecting on the development of grading rubrics in order to assess student work (Episode 3.1). The community needed to manage their own expert blind spots by attending to differing student prior knowledge and training in various scientific research areas (Episode 2.1.). Developing an understanding of students' current knowledge in scientific dialogues allowed them to retrospectively evaluate the difficulty level of already implemented sessions. Feedback from students in the form of end of course evaluations was collected every eight weeks of the first semester. This feedback provided additional data to the faculty about how to change their collective instructional efforts (Episode 3.1).

Fall semester, Second eight weeks.

In the second eight weeks of the curriculum, faculty had these same instructional responsibilities, continued to calibrate instruction, but the additional issue of the grading basis of the courses in the curriculum was discussed (Episodes 1.1, 1.2, 1.3; 2.1; 3.1, 3.2). The feedback from students and quantitative data in the form of graduate students medical course grades were known. This collective knowledge required faculty to revisit the grading weights in the syllabi to determine if the grading was too critical and also compare it against other graduate programs' grading practices. The politics of program operations and grading practices and negotiating the newness of the program was ongoing (Episode 4.1). Leadership was checking in with faculty on the status of the program and courses because they differed from the normal graduate curriculum. Funding was a topic of discussion heading into Spring semester because matching students to laboratory rotations and clinical observations for selection of dissertation laboratories was already being discussed (Episode 4.2). Faculty learning in the form of observing each other teaching, reading other course materials, and sharing educational articles was reported and observed (Episode 5.2).

Spring semester, First eight weeks.

Activities of the faculty community were at their peak during the first eight weeks of the Spring 2012 semester (e.g. 16- 24th week of implementation). At this time, faculty were continuing the foundational activities of the first eight weeks, still implementing new classes, calibrating instruction against students' progress in the program, and the last medical school course began (Episodes 1.1, 1.2, 1.3; 2.1; 3.1,). Each faculty member had

a turn at leading a PTSC course, managed the division of teaching responsibilities, and completed a round of PBL facilitation with the interprofessional medical and graduate student cohort. The faculty had shared instructional and program management experiences. They had jointly developed rubrics, syllabi, and a common method for planning sessions. Two student affairs issues surfaced during March 2012, an interpersonal conflict and at this same time a student unexpectedly dropped from the program after completing the most difficult coursework. These issues forced faculty to again revisit the rigor of the program's grading practices, recruitment decisions, and difficulty of the curricular content (Episodes 2.2; 3.2). Finally, faculty began experimenting with new instructional methods like, reciprocal teaching and challenge-based learning. Rick was applying the methods and rubrics of the program to other graduate courses he taught (Episode 1.4).

Spring semester, Final eight weeks.

The final 8-weeks of the curriculum implementation, faculty managed the final new course development and implementation activities in the research design course, which did not use the POGIL or PBL instructional method. A new faculty community member Chip managed the research design course. Post implementation activities, final course evaluations and faculty interviews about their experiences, occurred in the summer. Faculty reflected on their collective experiences with achievement and they were involved in scholarship and dissemination of the program's work (Episodes 5.2, 5.3). Grading rubrics and knowledge of the level of instruction were set.

Post Implementation

Faculty were heavily in talks about funding as the institution eliminated the internal budget in the next fiscal year and envisioning how the program methods and practices could be institutionalized in faculty development training and community expansion (Episodes 4.1, 4.2, 4.3). As part of the institutionalizing of the program, faculty expressed comments that indicated they had appropriate active learning methods and "owned" a collective view about their instructional philosophy of the program to train students in the competencies of the scientist. They could see no other way to educate (Episode 1.5).

Cross-Episode Synthesis

A review of the episodic timeline shows how the episodes were concurrent, and in some cases, repetitive. The five themes provide an organizing scheme for the data; however, development and implementation in one area of the curriculum implementation could also be connected to other areas. Across the program implementation, the episodes that spurred reflection and discussion in the community were not exclusive to that episodic theme. This section provides a synthesis of the interconnections across the five themes.

Theme 1: Instructional Development. Episodes in this theme relate to students' learning, assessment and evaluation, organizational and leadership development and individual career and professional enhancement. Developing course modules required faculty members to consider the ways in which course content and competencies would be assessed, such as grant proposals, through rubrics or examinations and quizzes.

Faculty then used these assessment tools to simultaneously determine adjustments to course materials or subjects.

When faculty began extending and experimenting with alternative teaching methods in other classes and other faculty, as in Rick's case, there was the potential for opportunity to influence other instructors' teaching skills. Agatha used reciprocal teaching and when her peers observed, they, too, were exposed to the method. This also applied to student learning.

In the last PTSC 5 course, which occurred at the start of the second implementation year, college teaching modules were integrated into the class. This required second year students to select one instructional method used within the program and develop a 2-hour class in order to teach first year students. College teaching was a developing competency. Considering these factors, organizational development could be realized through teaching new scientists evidence-based instructional methods and the reach of faculty community to teach each other new instruction and assessment tools.

Theme 2: Student Learning. Episodes in this section related to the theme of individual career and professional enhancement, organizational and program management, and student assessment. Through the realization that each faculty member had limited experience in handling student related interpersonal conflicts, it caused them to question, explore, and ruminate on a number of organization and program management related factors. As a new curriculum, the faculty had not previously considered that they could be confronting such a student interpersonal conflict or that a student would leave the program after eight months.

Faculty realized the value of existing university resources but it revealed gaps in faculty education on the procedures for how to handle interpersonal conflicts between students. Recognition of these gaps spurred them to outline guidelines for the program in order to establish professionalism standards in line with the competencies of the curriculum. Through this process, they each learned how they had a model to handle a similar issue in the future. They saw the conflict as an opportunity to teach professionalism. They believe that in the future a professionalism letter to students will be good practice for the broader university. Once the program is institutionalized, the faculty aim is to make a professionalism letter a part of all student orientations.

The last interconnection is for student assessment. Once faculty were aware of the interpersonal conflict, they agreed that evidence of a decline in academic performance of one student made sense when they looked at grades corresponding to the timeline of the conflict.

Theme 3: Assessment and Evaluation. As described in the theme of instructional development, assessment and evaluation related to instructional development, student learning and organizational leadership development. Rubrics, grading scales, and evaluation of ongoing student progress helped faculty to determine the progress students were making, as well as gaps in the curriculum. The grading basis was a delicate situation politically because the curriculum was based on different credit hour calculations than other graduate school programs due to the affiliation with the medical school courses.

Theme 4: Organizational Leadership and Development. Organizational and leadership development was enhanced through the interactions around funding, decision-making and in considering the future of the program. These episodes connected to all the other themes: instructional development, students' learning, assessment and evaluation, and their own career and professional enhancement. A part of faculty work in advising students required faculty to leverage the existing relationships they had with other research faculty in order to facilitate placements for student laboratory in rotations. Faculty conversations with potential research mentors were necessary to determine how personalities and interests of students aligned research faculty work. A good placement could mean future mentorship; a bad placement could result in difficulty in future research rotation placements.

Finally, determining the grading basis required bridging the policies and practices on grading in existing graduate programs and the components of the school of medicine. Assessment tools also provided formative data and feedback about student learning and progress in the curriculum.

Theme 5: Individual Career and Professional Enhancement. During the member checking session, faculty described the importance of conveying just how much they learned in the entire process. This learning spanned all areas traditionally associated with the activities and goals of formal, structured faculty development programs. This cross theme synthesis reveals the interconnections between the components of faculty work.

The results of this ethnographic case study suggest that faculty communities provide a social environment for faculty learning when work is created in collaboration, tools for teaching are shared, teaching is observed and feedback given, and reflection on the problems and outcomes of faculty community work is conducted in the context of its use. The next section describes the community attributes that supported reflection and action during the implementation.

Research Question 2: What is the role of collaborative reflection for advancing faculty members understanding of the innovative curriculum implementation?

The range of episode types and topic areas indicated in this chapter suggest that many reflective practice models could apply to this component of the analysis. To answer the second research question of interest, *what is the role of collaborative reflection for advancing faculty members understanding of the innovative curriculum implementation?* the 17 episodes were analyzed against these two reflective practice frameworks. I chose to focus on comparing episodes against two models: Mezirow's model of reflection as elaborated by Kreber (Kreber, 2001, 2005; Kreber & Cranton, 2000) and Brookfield's (1995) lenses of the critically reflective teacher. Kreber's nine-cell matrix was chosen because of its application to faculty development in higher education science teaching and Brookfield's model for its application to professional education. Where relevant, I reference other reflection models as cited in the literature review.

Curricular and instructional development activities provided the foundational experiences of the community, so the purpose of this phase of the analysis was to

compare the episodes within the context of these two frameworks to explain how I observed the group using reflection to advance their understanding of the program implementation.

I compared the data presented in the 17 episodes to Kreber's (2005) indicators of reflection aligned with the cells in matrix. Then I compared the episodes to three relevant areas of Brookfield's (1995) processes of the critically reflective teacher. These are: autobiographies as learners and teachers, viewing teaching through student learning, and the context of the education literature. I conclude the chapter by proposing a model for collaborative reflection for curricular and instructional development in a faculty community.

Analyses of Episodes by Type of Reflection.

Table 6.5 depicts a nine-cell reflection matrix (Kreber, 2005). The data from the 17 episodes were reviewed and sorted into the cell that was most closely aligned with a type of reflection. This process was completed by comparing description indicators from Kreber's (2005) study of reflection by science instructors to evidence from each of the episodes reported in this chapter. A completed table is presented with the summary of this analysis process. Below the table is a brief description of each cell.

Cell 1: Instructional Knowledge, Content Reflection. Kreber (2005) provides "indicators" of reflection reported by faculty science instructors about the instructional knowledge, content reflection cell (p. 339).

Table 6.5

Analyses of Episodes by Type of Reflection

		Reflection Type		
		Content (What?)	Process (How?)	Premise (Why?)
Knowledge Domain of Teaching	Instructional (Design of instruction; methods)	Cell 1 1.1, 1.2, 5.1, 5.2	Cell 2 1.2, 1.3, 2.3, 3.1, 3.2, 3.3	Cell 3 1.4, 1.5
	Pedagogical (Knowledge of how students learn)	Cell 4 1.2, 1.3, 2.1, 2.3, 5.3	Cell 5 1.3, 2.1, 2.3, 3.1	Cell 6 1.4
	Curricular (Goals and purpose of the program, courses)	Cell 7 1.1,1.2,1.3, 2.3, 3.3, 4.3	Cell 8 4.2	Cell 9 4.1, 4.3

The indicators of this cell include: articulating what one knows about instruction, discussing instruction with colleagues, and reading about teaching. The episodes previously described focused on the activities of instructional development of new POGIL course materials, in-class activities, assignments, assessment tools, and applying instructional techniques (Episodes 1.1, 1.2, 5.2). Faculty reflected on what they knew about teaching, planning the curriculum, the scientific topic, and how it could be applied in the instructional design of new courses. Planning included reflection on prior experiences of teaching, Gus' bringing articles and evidence-based research information to the group, and use of the planning sheet to map out the content of classes.

Faculty discussed their teaching with colleagues because colleagues were observing that teaching and class sessions were collectively debriefed during weekly

meetings. At some point before the program implementation, the faculty had collectively participated and read materials about the POGIL instructional method, so they had a concept of what the method required in a class setting.

Cell 2: Instructional Knowledge, Process Reflection. The indicators of this level of reflection included: collecting information from students about the teaching approaches used, paying attention to student evaluations or opinions about instruction, and collecting data about student desired changes (Kreber, 2005). The episodes the triggered reflection on instructional process were implementing new instruction (beyond the first few weeks of classes), instructional evaluation, understanding the role of scientific dialogues in learning scientific habits of mind, rubric development, determining the grading basis, and assessing student progress (Episodes 1.2, 1.3, 2.1, 2.3, 3.1, 3.2, 3.3).

Reflection on the process of how instruction was impacting students allowed the faculty to make adjustments to grading, the types of rubrics that were developed and implemented, and influenced future instructional implementation. Calibrating instruction to the level of student's prior knowledge through the instructional POGIL conversations between students and through their written work and grant presentations, the faculty community reflected on the impact of the instruction on student learning. When the faculty completed the full year of the curriculum, they also challenged themselves to examine the potential gaps in student knowledge in the area of physiological structure and function.

Cell 3: Instructional Knowledge, Premise Reflection. The indicators of this level of reflection included: the experimentation with additional instructional methods, changing instructional approaches based on one's evaluation of the suitability of an instructional method in a given context, and discussing approaches with colleagues that resulted in some change to teaching (Kreber, 2005). The faculty community demonstrated premise reflection on instruction in the third eight weeks of the program when they began to experiment and extend the types of instructional methods they used. This was also the time when Rick adopted the active, or inquiry-based teaching methodology as a process most effective for teaching science (Episodes 1.4, 1.5).

Cell 4: Pedagogical Knowledge, Content Reflection. The indicators of this level of reflection included: faculty ability to articulate how students learn, listening to others talk about student learning and writing or discussing it, and asking students for their instructional preferences (Kreber, 2005). In the first day of the curriculum, Gus presented the curriculum to students with an overview of the teaching method. During this instruction, there was discussion with students about how they felt they would best learn. This activity was one of the first events of the program implementation and faculty hearing from students how they like to learn. Since the entire faculty observed this session, they understood what each student contributed to that discussion.

The faculty demonstrated reflection on pedagogical content knowledge in several other episodes including the collective evaluation of the fit of the POGIL method, discussions on student prior knowledge, science content alone does not create a scientist, and Agatha's scholarship on the problem-base learning issue paper abstract she submitted

to the international medical educator's conference (Episodes 1.2, 1.3, 2.1, 2.3, 5.3). These reflections were on classroom experiences and also included consulting the literature to develop the learning issues paper.

Cell 5: Pedagogical Knowledge, Process Reflection. Reflection in this cell required faculty to be aware of how what was happening in their classrooms influenced their students (Episodes 1.3, 2.1, 2.3). The indicators of this level of reflection included: checking for student understanding in class, observing others' teaching and students' reactions to it, making efforts to know students beyond the classroom, and paying attention to the kinds of questions students ask (Kreber, 2005). Since the POGIL instructional method was an inquiry-based approach, a lot of questioning occurred in the class. Class was filled with conversation and scientific dialogues.

Agatha's approach to instruction, as a coach and guide in POGIL gave students more autonomy, but she used the circle-dash diagrams to track students' questions and dialogue exchanges. This method provided evidence that although Agatha was less vocal, she had a grasp on the types of students' questions. She intervened when clarification or a request for help was made.

While Rick demonstrated greater self-regulation of his tendency to lecture in class (his own and colleagues'), when he intervened in a student's college teaching segment, Gus was quick to point this out to him later, which Rick acknowledged. A faculty members' ability to manage their own expert knowledge, also appeared to influence if faculty could attend to the pedagogical process with their students'. So while Rick was

not initially effective in this area, by the end of the curriculum, he was able to monitor his own expert contributions and realize their effects on the students.

Cell 6: Pedagogical knowledge, Premise Reflection. The indicator in this area was about the effect of instructional experimentation on student learning (Kreber, 2005). When faculty experimented and evaluated the alternative instructional methods they tried, Gus with challenge-based learning, Agatha with reciprocal teaching, and Rick using POGIL in his non-program graduate classes, there was some reflective discussion about the effect of trying new methods in the classroom (Episode 1.4). Agatha made the explicit metacognitive links to the benefit of reciprocal teaching for scientists for both students and in description of the session to faculty. While I did not observe Rick's instructional experimentation, Rick compared the translational sciences program students to the other classes, where facilitating discussions was difficult. Gus reflected briefly on the challenge-based instruction experiment, explaining that what he had done in class was probably what was intended of the method. Reflections of faculty on pedagogical premises were based on actual teaching experiences, as well as a faculty review of educational literature on each of the methods.

Cell 7: Curricular Knowledge, Content Reflection. Reflection in this cell required faculty to articulate and document the goals of a course and the program (Episodes 1.1, 1.2,1.3, 2.3, 3.3, 4.3). Faculty spent time reflecting on syllabi, the construction of syllabi modules, and the ways in which the courses and the program operationalized the competencies of translational science from the original grid of the curriculum. They spent time mapping the PTSC courses to the medical school course

PBL topics, writing learning objectives, and documenting the corresponding competencies in the syllabi that each class session would cover. Faculty also reflected on curricular content in the context of how the future of the program, its methods, aims, and practices would be institutionalized.

Cell 8: Curricular Knowledge, Process Reflection. The indicators in this area of reflection includes the examination of how what is taught can influence the future of the student, help them gain employment, and then discussing these areas with colleagues (Kreber, 2005). While not explicitly stated in the data, the overall purpose of the program as something that could influence the future training students in translational research was something that faculty understood from the pre-program launch period, when they were discussing funding mechanisms for a new curriculum in translational sciences. This overarching goal aligns with the future roadmap of the National Institutes of Health (NIH) and therefore will ultimately trickle down to all institutions receiving NIH funding. The curriculum aimed to bridge a training gap and operationalizing new models for interprofessional translational sciences training. Reflection on funding sources could be sorted into this cell because of its tight alignment with the mission and vision of the NIH to fund translational science oriented research in the future (Episode 4.2, 5.1).

A second episode that was placed here is when the faculty established their initial community (Episode 5.1). Agatha stated that they discussed how few people could appreciate how a new program could be established within the context of a very old, structured institution. All of the planning that went into the initial conceptualization of

the program required them to articulate the benefit of the new curriculum to stakeholders within the university.

Cell 9: Curricular Knowledge, Premise Reflection. The indicators of premise reflection on curricular knowledge include consulting with the institution for the goals they have in mind for the program and participating on a curriculum review committee. These areas of reflection for the community are through negotiating the organizational structure and the future of the program (Episodes 4.1, 4.3). This data suggests premise reflection on curricular knowledge primarily occurred at the launch of the program and then after a full year of the program was implemented and assessment was required.

Summary

The data from the 17 episodes were reviewed and sorted into the cell that best explained the type of community reflection. This process was completed by comparing description indicators from Kreber's study of reflection on teaching by science instructors to evidence from each of the 17 episodes. A review of the complete nine-cell matrix suggests that reflection was more frequent across instructional content reflection, instructional process reflection, pedagogical content reflection, pedagogical process reflection, and curricular content reflection.

Brookfield's (1995) Four Lenses of the Critically Reflective Teacher

As stated, Brookfield's (1995) reflective process includes four complimentary lenses: (1) knowing oneself through autobiography, (2) seeing oneself from the student's point of view, (3) receiving feedback from others and (4) comparing one's teaching to the literature.

Autobiographies as Learners and Teachers. It is instinctive to fall back on our own experiences as learners to inform our teaching. But as Rick revealed in his interview, he did not learn to be a scientist by sitting in a lecture hall in graduate school. His authentic work experiences at the NIH were the most formative in becoming and learning to think and act like a scientist. When he reflected on this fact, he had an epiphany that helped him connect to the educational methods and philosophy of the program that was being promoted. He recognized the value of learning to learn, versus learning content, because the knowledge of how to learn new information will always be useful. Whereas, the knowledge delivered to students through lecture will one day be obsolete and they may not have developed the tools to learn in new and efficient ways. Gus, too, advocated for the program because of his own experiences with a lecture-based program in graduate school.

The Students' Point of View. Although faculty received feedback from the students about instructional approaches and topics, it was an area of reflection that challenged faculty. The expert blind spot was apparent, for example, when students provided feedback about the difficulty of the essay style examinations. Faculty expected students to perform well on the tests and did not change the format or content of the testing. This was a situation in which reflection on testing practices did not result in an action or decision to change the tests. Faculty stated that part of the difficulty could be that learners were not accustomed to this style test. Another argument from faculty was that the *faculty believed* the test content to be manageable and therefore concluded the students should have, as well.

Second, they did try to understand students' problems during the interpersonal relationship issue and the student who dropped out of the program. Initially, faculty were surprised that the group was in turmoil or that a student wanted to withdraw from the program after completing the most difficult components. Upon reflection, they realized that they were accountable for a possible failure during the student recruitment process. They also tried to support the interpersonal issues of the other students, as they were very concerned about the effects these student issues would have on the other students' learning and group work.

Peer Observation and Feedback. Brookfield (1995) discusses the value of peer observation in becoming a critically reflective teacher. While it is difficult for many faculty to invite colleagues into their classrooms, peer observation can be beneficial when it includes colleagues you trust and they are supportive. Faculty members who have taught similar topics or who have had similar experiences also makes the process easier. For Rick, the fact that he was not first in this process assisted him when it was time to be observed by Agatha and Gus. Reciprocal observation eliminated the power differentials that could have influenced the relationships between the colleagues, when one has observed and the other does not return the courtesy (Brookfield, 1995). In terms of the students, faculty informed the students that they would be participating and observing each other in classes because it was a new curriculum.

Educational Literature. The last area of Brookfield's perspective on reflection concerned the use of educational literature to support or validate experienced based practices. Intuition about the "right way to teach" may be validated or elaborated by

consulting the educational literature or, "naming" those facets of teaching practices, which may seem unique to an individual or situation (Brookfield, 1995, p. 36). For example, a faculty member may believe that their students are unwilling or unable to participate in group discussion, regardless of his efforts. The literature can also help faculty understand student motivation, or to use effective pedagogical practices relative to the subject matter. Evidence of the use of educational literature was in how faculty used educational terminology in conversations with me. Language I noted included: inquiry-learning, POGIL, reciprocal teaching, metacognition, authentic assessment, learning portfolios, challenge-based learning, curricular maps, scaffolding, formative and developmental evaluation methods, group cohesion, student self-question generation, feedback, self-explanations, reflective writing, and rubrics. Occasionally, faculty shared educational stories that aired on National Public Radio and periodically circulated articles from Science Education journals, such as on the topic of metacognition.

Research Question 3: What do community interactions reveal about the nature of faculty learning in practice?

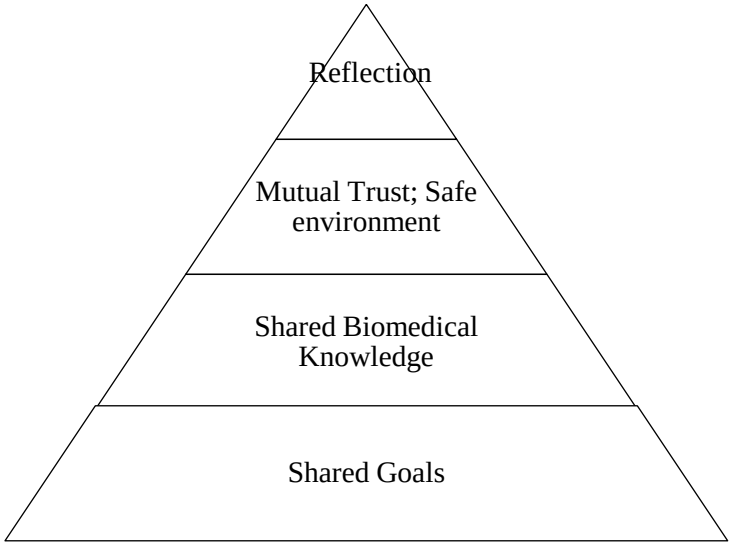
The Pull of The Community: Social Supports for Reflection and Action

Data from meetings, interviews, and observations suggest that several attributes contributed to community's ability to function over the course of the program implementation. These attributes included: (1) common biomedical domain knowledge, (2) shared goals or purpose, and (3) safe social and emotional context (e.g. mutual trust). These elements contributed to the social support in the community and may be depicted

as a hierarchical pyramid (Figure 7.1). The pyramid is weighted at the base by faculty's common, overlapping biomedical knowledge and expertise.

Figure 6.2.

Levels of Faculty Community Attributes



Shared goals. Initially, Rick, Gus, and Agatha had disparate ideas of what implementing the curriculum and guided inquiry instruction meant, but they still had a common goal to make the program happen. As Agatha explained in her interview, Rick had made the commitment to the university to direct the program, so they had to make it happen [091412]. Faculty observations in one another's classes in the first eight weeks of the program suggests there was a shared responsibility for being involved in the curricular implementation.

Common biomedical domain knowledge. Each faculty member had prior experiences teaching biomedical sciences, Agatha and Rick taught for ten years in the

medical school, and Gus had previous experience teaching medical residents and graduate students. Each faculty member was trained as a medical doctor (Agatha, Gus) or had worked with medical doctors and been trained in medical courses (Rick). This experience likely resulted in developed scripts or schema for teaching within the domain, for example, how to deliver effective presentations describing cellular functions.

Across the curriculum, but focused on the first three eight week segments, faculty engaged in scientific discussions. During peer observations, faculty would converse with each other or ask questions. The nature of knowledge being taught in biomedical science is highly contextualized and specific, for example, the average person without science training and education cannot observe a conversation about adrenergic signaling receptors and understand what those are [Memo, 102312]. Faculty shared this similar disciplinary background, the scientific language of the community, so they could converse about their teaching and classroom modules even though their specific research expertise had evolved over time. For example, Rick in cancer, Gus in virology, and Agatha in pathology services.

Safe emotional context. The strength of the community relationships facilitated "getting things done" [Gus; Memo, 082012]. Two areas indicate the development of this environment: a trust and respect for one another's intellectual contribution and level and the growth of personal relationships.

1. Trust and respect. The trust and respect allowed the community to focus on the work, including the development of the rubrics, feedback on teaching and evaluation

of the curriculum progress. From the beginning of the collaboration, faculty described having respect for each other:

> Agatha: *[The HHMI grant work] seemed like that kind of established, um, not only in some ways our roles and interests and expertise, but just kind of I guess ah, in some was a, ah, common ground, or a mutual respect or something and it was very easy to work together. [Interview, 091412]*.

Faculty exhibited trust towards each other to take responsibility for their instructional modules. Meaning, they relied on one another to teach the segments to which they were assigned and filling for each other when competing demands of work (e.g. a grant deadline) interfered with their time to teach.

> Agatha: *I cannot express to you how uncomfortable it makes me (voice elevates) to be on the first day of a course and have no idea what the syllabus looks like, what the session plan is, you know what I mean that's how we, that's basically last year the whole year and so I was out of my comfort zone but what I realized is, that I think the instruction came out OK, so it made me realize that being wedded to some syllabus, some little list of stuff didn't always a) it didn't always ensure a good product and b) isn't always necessary for a good product. It would be better if we had that but I guess it made me realize that my insistence on adhering to some kind of list or schedule can be limiting and that um, that at some level I, I just have to trust the team members to get their part done and to know that they are trusting on me to get my part done. So I I think its its helped me a little bit with um not just delegating but delegating to people's strengths and then trusting them to deliver on what they're doing I'm still not very good at that (laughs) but I am getting better [Interview 091412]*.

For example, Rick had a grant renewal due in Fall 2012 and Gus had a promotion packet due so Agatha stepped in at his request to teach a course [Notes, 022813]. In addition, the first eight weeks of the curriculum Rick's family member was ill with cancer, so Gus and Agatha worked around his absences from work in scheduling his instructional responsibilities [Syllabus notes, 2011].

Another moment where trust was exhibited was when one faculty member had performance difficulties and confided them to the group. During the discussion he was visibly emotional, but the faculty member's colleagues listened and made suggestions on options for addressing the issue [Memo, 072012].

While outside the community, Rick even described the trust that the leadership of the university had in him to support the program idea from the beginning, which indicates the role that leadership support could play in the faculty community's work. Rick expressed that this leadership trust influenced him to ensure the program's success:

> Rick: *I was given an opportunity to run with this idea, he trusted me to do something good with it. I think he is satisfied with what we have done. Leadership appreciates our efforts [Interview, 083112].*

2. Personal relationships and community language. Faculty developed personal relationships outside of work. They hosted pool and Christmas parties that included students [Calendar Memos, 121212, 082912]. Faculty also engaged in meetings off campus, which they called "beer-thirty" [Memo, 120111]. Beer-thirty was started when the faculty meetings had moved to Friday afternoons from three until five in the afternoons. Rick suggested the meetings could be held at a local restaurant across from campus and Agatha sent out a note inviting the group to "beer-thirty" [120111]. Initially the idea was to celebrate with "birthday beers" [120111], and the forthcoming year-end holidays. Eventually, beer-thirty became a somewhat regular event in the warm weather.

Additionally, jokes revealed common language of the community and the evolution of the relationships. I observed a running joke about Rick's lack of instructional preparation in the second Principles of Translational Science Course (PTSC

2), “yeah, like Rick’s syllabus” or “oh, you mean they want to know what assignments are due?” or “No syllabus, whatever” [Memos, 111811, 112911]. When he finally prepared a syllabus, in *year two* of the curriculum implementation, his colleagues applauded him [Memo, 102312].

Being *caustic* was also another community word. Caustic referred to Rick’s interpersonal skills. Faculty used the word “caustic” to harass Rick when his caustic side was showing. The label came from Gus who, upon being invited to join Rick’s effort to revise the existing graduate program to a translational program. Gus reported that he initially didn’t like Rick, and thought he was “caustic” in meetings, so he was initially unsure of the way they would work together [Interview, 082312]. Rick reacted to this idea that he was caustic:

> Rick: *That’s the other thing, I hear things like that [being caustic] and I responded to it, I don’t want to be seen that way, and I can be caustic, petty, but those aren’t the behaviors I want to reinforce or perpetuate, so it is important that someone tells me that and my feelings might be hurt but I gotta get over it, because I don’t see those things as virtues, those are things that you want to change. You want to try and get better, and this really is why it comes down to this educational thing, I want to be better I want to see it change, I think it’s a better, it can be a better way to go, and right now its convincing other people this could be a better approach [Interview 0831212].*

Agatha emerged as the mediator within the community, merging the different ideas of Rick and Gus through her abilities to mediate:

> Agatha: *I was a certain kind of, I was a mediator, sometimes I would play the devils advocate for one side or the other because I do kind of think that Gus can be pretty firm and dogmatic on his side and Rick can be pretty firm and dogmatic on his side and I know I can be firm and dogmatic on my side, but I can also say I feel like this is what I feel like I do….I can say ya know, Rick I see your point, but here is the point that Gus is trying to make, can’t they merge in this way? Or something, like that. I feel like that’s what I did..[Interview 091412].*

Rick echoed this view that Agatha had of herself:

> Rick: *Agatha, she was the constant, she's kind of the glue that got Gus and I together and me really buying into his approach…. Agatha's influence early was absolutely essential. She is extremely diplomatic and, and, in a good way. Just very in tuned to, she can come into a situation and be very in tuned to multiple people's opinions even if they are in conflict with one another. [She] can get them to feel comfortable. And early on when I wasn't getting it, I would listen. Cause, Gus had already said that I was "caustic" so I was sensitized to that and didn't want to be caustic, so I would listen, but in my mind I wasn't really getting it yet. I didn't know I wasn't getting it at that point I just didn't think that it [process oriented teaching] was the right way to go. I didn't think people were going to respect us if we were saying we didn't have biochemistry and this and that. They weren't going to see the program as being important. So I was concerned about that, but but Agatha because of her way, her kind of empathy that she has and her diplomacy, and its really diplomacy, she's really an excellent diplomat, as opposed to a politician, she's a diplomat because she can see other people's sides. So she could understand me, she could understand Gus, and she didn't try to force, but was always there as kind of a stabilizer. She compliments ideas, she's hears ideas, and she can articulate things so she was really key to getting past what could have been two males butting heads over which way it should be. She could reshape the problems so that they were depersonalized and bide the time for me to come along and learn. [Interview, 083112].*

Agatha was explaining she was frustrated that no one had provided comments or thought on a revised version of a syllabus. Another community in-joke was that Rick did not respond to Agatha's emails, so she reiterated in a meeting, "ok, I'm sending that around" and Rick jokingly replied, " Do you want a response?" He went on to explain how he hates long emails because he cannot read them on his iPhone, which is why he sometimes does not respond [Memo, 090712].

Community Artifacts: Community Memory and the Distribution of Expertise

"Artifacts of a community are not only sources of stimulation and guidance but are vehicles of thought" (Salomon, 1993, xiii). Artifacts, like planning documents and

syllabi were tools for reflective conversations about the curriculum instruction, and also served as documentation of the work, or a form of memory for the community. Blackboard and the Personal Brain software tool provided memory repositories for the community of the work that was done. The distribution of community expertise was managed through these shared tools.

The *planning guide* achieved several aims in the community. Instructional planning sheets standardized instruction across multiple instructors and recorded learning objectives tied to the curriculum competencies, regardless of who taught a session. The instructional planning guide provided uniformity in classroom modules, provided a record of course activities for program evaluation at the end of the semester, helped instructors explicitly map professional competencies to course topics, and provided a tool for training future program faculty (Appendix C). Planning sheets supported fidelity in instruction when a faculty member needed to switch sessions due to schedule conflicts when the second cohort of students started the program. The planning tool served as a scaffold for faculty to implement instruction aligned with the active learning educational philosophy advocated for the program and consistently with other faculty.

Syllabi and *rubrics* provided a guide for instructional development and also the external memory of the community. Syllabi were reviewed weekly for the future topics to be covered, activities, and due dates for assessment. Rubrics were developed by the faculty and shared with one another. The rubrics provided standard assessment criteria for activities and assignments within the program, regardless of who taught a class.

Blackboard was a repository for all instructional materials and student assignments. Faculty members had access to the Blackboard site for all classes. Upon review and reflection of the completed Blackboard course site, the repository aided the faculty in making adjustments to the curriculum. In the second semester, faculty were frustrated with the Blackboard site functionality, so they decided not use it [Notes, 100311]. It was pointed out by Rick that not using Blackboard was a mistake in the third eight weeks. He described feeling like he had no knowledge of what was done in the second semester and what reading materials the students were provided. He thought it was a huge disadvantage and later Agatha agreed [Notes, undated].

Finally, the *personal brain* was a database program that depicted curricular topics in an interactive concept-map. Tasks of the faculty were recorded in the brain during a mid-year debriefing. Faculty later returned to the *personal brain* to see what curricular tasks needed to be completed.

In total, the syllabi, rubrics, planning sheets, Blackboard and Personal brain tools will help build the knowledge of the program and will be tools that can be used in the institutionalizing of the program. As faculty stated in the member-checking session, they hoped these would be useful tools for orienting and training new faculty to teach in the program [Notes, 021713].

Chapter Summary

The results described the types of activities or episodes that were triggers for collaborative reflection, how the episodes occurred in the curriculum implementation over time, and a cross-theme synthesis of episodes. The data analysis revealed that

multiple episodes were sources for reflection by the faculty community. A total of 17 episodes were presented and described as triggers for community reflection during the program implementation. The episodes were organized around five major themes; (1) instructional development, (2) student learning, (3) assessment, (4) organization and program management, and (5) career and professional enhancement. The results also described a negative faculty case and summarized how the pull of the community and its shared attributes contributed to reflection and action.

CHAPTER 7

DISCUSSION

This research sought to understand the role of collaborative reflection for advancing a faculty community's understanding of an innovative curriculum implementation. In conclusion of this project, this section attempts to answer the question: *What does this research contribute to our broader understanding of faculty communities, faculty development programming, and faculty learning in mid-career and senior career phases?* This chapter offers several practical and theoretical conclusions, as well as recommendations for future research. I also discuss limitations to the research and potential researcher effects.

Practical Implications

1. A faculty practice community can catalyze organizational changes proposed for biomedical graduate education.

Multi-school Structure. The community's work could be perceived as a challenge to the existing structure and process of both medical and graduate biomedical education, simultaneously. The faculty community had to coordinate multiple school structures, systems, and processes, such as grading standards, curriculum requirements, and timing of classes in both medical school and graduate programming. This demonstrated that multidisciplinary models of curriculum oversight are difficult, especially when they bridge multiple schools within one institution. It can be done and provides leaders within institutions a possible model for the structuring of a multidisciplinary translational graduate program through using faculty community.

Instructional Change. The data provided in this study on how many planning hours faculty reported investing in instructional development, demonstrates that active learning methods initially require a substantial investment in planning and development of individual class sessions. Overtime, however, faculty reported that the time investment declined. After the community reviewed the table of the planning hours they reported, they briefly discussed that while the initial investment of time was extensive, that in-class effort is less. Students were navigating the concepts and learning activities through more autonomous learning.

Lecturing was a predominant teaching approach to graduate school as described through Rick and Gus' own experiences. Giving up control of a course to colleagues and facilitating discussions in class can be uncomfortable, as faculty revealed. Ultimately, faculty perceived active learning methods as *the* way to teach. While the student metrics and data on learning outcomes are still being examined, faculty qualitatively perceived a difference in these students as compared to the students in their other purely lecture-based courses.

Finally, the program was nationally recognized for innovation in researcher training (AAMC, 2012). This recognition does validate the work of faculty members and it has the potential to generate interest from other faculty members to engage in dialogue about the methods used to attain this honor. Broadening the reach of the program can influence the organizational practice of other faculty and programs (Camblin & Steger, 2000).

Team Science. Historically, an educational model that was characterized by developing the autonomous expert has guided medical education structure and process (Bleakley, 2006). While medical education more recently has moved towards active group learning methods, such as problem-based learning, the emphasis is not on the specific development of team skills, but rather to foster individual diagnostic expertise (Cooke, et al., 2012).

The National Institute of Health National Center for Advancing Clinical and Translational Science (NCATS) promotes the effective team-based scientific research through the collaboration of scientific and clinical experts, many of who were taught in an autonomous model. Faculty communities of clinicians and biomedical scientists can model collaborative skills that are the very core of team-based science (See Bennett, Gadlin, & Levine-Findley, 2010).

Clinical Research Training Models. In some MD/PhD programs, there is little integration of the curriculum; rather, each degree and its individual requirements are sequentially pursued. For example, students complete two years of medical school, complete the PhD requirements, and then students return to complete the final clinical clerkship period. An interdisciplinary curriculum model may address this lack integration in MD/PhD programs, reducing reported duration and attrition rates.

Further, there is a shortage of educational research that investigates the power of multidisciplinary team research models on developing trainees' research competencies (Feldman, Divoll, & Rogan-Klyve, 2013). The field of translational sciences has important aims, yet attention needs to be paid to the faculty members tasked with

implementing team-based research models, interprofessional educational formats, and adopting new instructional approaches to foster foundational partnerships. The successful implementation of curricular innovation rests, in part, on the varied expertise of clinical and research faculty working and teaching together in collaborative relationships.

Faculty development through faculty communities may be one method for achieving the teamwork and collaborative aims of translational sciences training programs. Even with developmental support, there will be a population of individuals who do not see the merit of such changes, and this is where a faculty community may help shift the research culture to one that is more collaborative.

Cultural divide. There were also professional culture differences, often referred to as the *cultural divide*. The cultural divide is defined as a gap in the abilities of biomedical researchers and clinicians to understand, respect, and appreciate each other's contributions, especially in the translational research enterprise (Restifo & Phelan, 2011). The divide may be attributed to differences in education and training processes, reward mechanisms and motivations that create barriers to communication and collaboration.

The cultural divide was a deeply held assumption in the community because the faculty were a part of the very system they were trying to influence. Faculty articulated the program's reason for being was to break down this divide, to bridge the gap between biomedical researchers and clinicians to understand, respect, and appreciate each other's contributions, through teamwork and interprofessional education. Simultaneously, faculty maintained the *paradigmatic assumptions*, the deeply embedded facts and beliefs that drove their actions and organized the reality of the practice of science, and

prescriptive assumptions, what they expected to happen in a given situation (Brookfield, 1995).

For example, the community engaged in discussions about the differences between neuroscientists and neurosurgeons. There was a joke about the likely pay differential. Neurosurgeons make a lot of money for essentially "scooping out" portions of the brain. Neuroscientists, on the other hand, need to understand the brain at a much deeper level of complexity. This deeper level includes understanding what the axons and neurons do, effects of disrupted neurological connections, the proteins and chemical reactions occurring at the cellular level, which helps scientists to develop targeted therapies.

Brookfield suggests using an ideology critique, or critical incident method, to help faculty surface these tacit assumptions that are expressed in everyday language. The ideology critique process could contribute further to faculty recognizing the perpetuation of the cultural divined in their language and foster change.

When I presented the theme of the cultural divide in the member checking session, faculty were confused. This lead me to the possible conclusion that these beliefs were so deeply ingrained in ways of being a scientist that faculty could not reflect on them at a surface level; thus, the very purpose of the curriculum was targeting this change. This area of conceptual change in beliefs about science teacher's professional identity could be explored in future research.

2. Longitudinal qualitative methods are useful to revealing the incremental and progressive nature of experienced faculty members' learning.

Ongoing development of faculty in the community was a process that began with multiple priorities and concurrent activities that required problem solving and collective discussion and decision-making. The results described 17 different faculty practice community activities that were prompts for reflection. Over time and repeated occurrences, the results of the longitudinal episodic analysis suggest that changes in conceptions of teaching and learning occurred for faculty, primarily Rick and Agatha.

While engagement in collaborative reflection in a community may overcome barriers to participation in formal faculty development activities, learning within a community appears to require regular interactions over time. This study supports the prior findings that learning through reflection in faculty community appears to require regular interactions, such as through small group meetings (Tigelaar et al., 2008). Chip did not realize the same benefits of the supportive or transformational aspects of community membership. The results of this study provided evidence that a faculty member, Chip, who was peripheral to the community, partially engaged, but not fully engaged in the long term activities of the community (meetings and peer observation of teaching), did not realize the same benefits as the other faculty members, particularly in the area of instructional development.

A surprising finding was the extent of individual learning and professional development reported by faculty. While it was hypothesized that faculty would learn from one another based on the fact they were implementing a curriculum for the first time, each faculty member was experienced in their faculty roles. Agatha and Gus had been through a teaching scholars program that was twenty months long. Rick had been

teaching for more than ten years. I certainly did not expect Rick to report how transformative of an experience it had been for him. Agatha, too, emphasized in the member checking session how important it was for me to be clear about the extent of the learning and development that occurred in the group over time [Notes, 021713]. The study demonstrated the diversity of learning that occurred within the community and how collaborative reflection was integrated into the every day activities and tasks of the community.

Instructional Development Process of the Faculty Community. Collaborative reflection occurred in response to multiple episodes that occurred during the curriculum implementation, but was focused primarily on facets of instruction, which was the dominant work of the community. Collaborative reflection enabled decision-making on instructional content and process, pedagogical content and process, and curricular content. A cyclical process of instructional development emerged in the community including: session planning, implementation, collective teaching observation, and collective instructional evaluation.

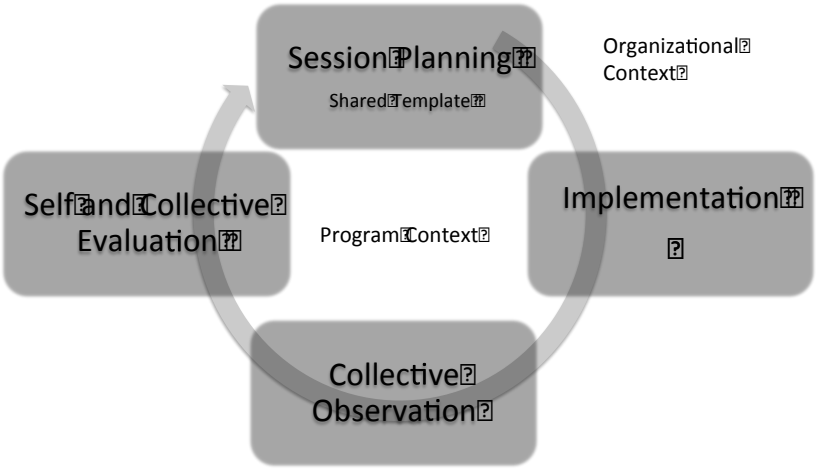
The three types of analyses reported in the results on *Instructional Development*, the episodes, the episodic map, and the reflective matrix analyses, indicated that collaborative reflection in the development, implementation and evaluation of instruction followed a pattern that was repeated across three new course implementations. A cyclical process of instructional development emerged (Figure 6.3).

Faculty worked on their instructional modules independently (Development, Episode 1.1). The session was conducted and peers observed the session

(Implementation, Episode 1.2; Peer Observation). Several days later at the weekly meetings, there was a collective debrief of the sessions for the week and a planning discussion about the sessions for the next week (Evaluation, Episode 1.3). The evaluation of instructional content and experiences, peer observation and feedback, and end of course student feedback, when available, provided a continuous reflective feedback loop for future instruction.

Figure 6.3.

Instructional Development Process of the Faculty Community



Similar to the process described by Menges and Austin (2001), faculty instruction generally followed three phases: planning, implementing, and evaluation. In the case of faculty community, each of these phases was influenced by collective peer observation and collective evaluation of teaching. Further research will explore the refinement of this model and test the validity of its phases for faculty teaching improvement.

3. Instructional development occurs overtime when a community is supportive, trustful, and collectively reflects on its members' instructional efforts.

This study suggests that facets of the workplace community can support learning as proposed by O'Sullivan and Irby's framework (2011), but learning is more probable if the community in which faculty are embedded is a trusting one. In particular, if peer observation of teaching occurred with a community, trust may reduce what is already perceived by some faculty to be a stressful situation (Martin & Double, 1998). Trust, along with shared domain knowledge and work goals, helped this community to engage in collaborative reflection on different activities in the curriculum.

4. Faculty members can learn across multiple career areas, such as instructional, assessment, and leadership through participation in a reflective faculty practice community.

The interrelationships between episode themes, such as links between student learning, politics, assessment, funding, organizational structure, and instructional development, shows the complexity of faculty work. These facets of the workplace community provide a source of challenges, problems and obstacles which faculty needed to overcome in order to keep the program moving forward. Simultaneously, these everyday facets of the workplace provided faculty with control, autonomy, and interest over their work together, which along with the social pull of the community kept the faculty engaged, even when the tension of competing work demands (e.g. research, writing, grant work, conferences, and administration) was ever present.

5. A situational faculty development model, embedding an educator within departments, or focusing on work groups longitudinally may be useful. This study supports existing literature on the value of communities for faculty development, although it not a model that would apply in every situation. The individual needs of faculty learning cannot be met with a uniform approach to faculty development. As prior literature reviews have revealed, workshops, seminars, and courses can attain a measure of professional enhancement, but concept transferability or content etention may be limited since the experience is separated from the context of immediate application (McLean, et al., 2008).

A faculty community model where collaborative reflection is integrated, allowing each of its members to learn based on what they deemed necessary to their own stage of development. Further, the immediacy of application adds value to the whether or not skills or new knowledge will be learned or retained (McClean, et al., 2008).

Support of faculty development in a shifting educational climate is significantly important (Dath & Iobst, 2010); however, the method of that support may need to be reconsidered. My experiences being embedded with this faculty community over the fifteen months and the data summarized in this study suggests an alternative model for faculty development practitioners. Faculty development needs to occur where the work of faculty is enacted. The work is more than consultative but highly situational, driven by the needs and requests of faculty members and departments with whom they interact. *Situational faculty development* draws from the nature of faculty development work and

more directly from organizational sciences and situational leadership theory (Blanchard & Hersey, 1969; 1977).

In particular, situational leadership posits that a leadership approach is on a continuum of high involvement to low involvement activities that are task, job function, and performance level dependent. In organizations, novices or low performing individuals would receive more directive leadership than high performing, self-directed individuals. Blanchard and Hersey (1969) described several phases of activity on the part of the leader, from telling and directing (high involvement), selling and coaching, participating and supporting, to delegating (least involvement). These levels are also related to employee maturity in experience or skills. In theory, as employees become more effective in their roles, they move from requiring directive leadership to delegating leadership.

In faculty development, a similar model could be a guide to developing leaders in teaching, organizational leadership, and assessment. As faculty begin as assistant professors, they have more orientation activities and workshop participation. The type of support shifts overtime and experience. As faculty enter mid-career, consultative faculty development could be more useful. A model would need to be developed and tested further, however, it seems relevant to blend both educational and organizational ideas to move the valuable role of faculty development and organizational change in science education forward in higher education institutions.

It is important to understand the work of faculty within the unique attributes of their departments, discipline, and organizational culture or the challenges they face in

every day teaching through observation and support. Even within a single university, the norms for that department around teaching may differ than another department. The participant-observer/evaluator relationship with the faculty allowed me to observe process and practices of teaching and without trust; it would not have been possible.

In summary, the practical recommendations from this research are:

1. Faculty communities can help catalyze the organizational changes proposed for biomedical graduate education.
2. Faculty members, through participation in a reflective faculty practice community, learn across multiple areas of development, such as instructional, assessment, and leadership skills.
3. Instructional development occurs overtime when a community is supportive, trusting, and collectively reflects on its members' instructional efforts.
4. Longitudinal qualitative methods are useful to revealing the incremental and progressive nature of experienced faculty members' learning through community.
5. A situational faculty development model, embedding an educator within departments, or focusing on work groups longitudinally could contribute to our understanding of faculty development more intimately.

Theoretical Implications

This study represented an exploration of faculty development through faculty communities as they are engaged in the daily complexities of working on the implementation of a novel curriculum. Theoretically, the study sought to advance our understanding of faculty learning through interaction with similar level peers in a workplace community structure. I applied sociocultural models of learning to understand the dynamic interactional and interpretive processes of faculty community as a social system in which tools, artifacts, language, and norms of the community reveal the complexity of learning within a group.

I applied Salomon's (1993) interpretation of distributed cognition theory, a *dynamic interactional* approach, where there is shared cognitive labor and reflection on the activities of the community that facilitates the functioning of the system. Faculty community developed external memory tools to store their collective work. These tools were in the form of syllabi, planning sheets, the Blackboard course site, and the personal brain software. They also relied on each other to recollect facets of the work as it progressed. Faculty memory was also connected to its members. When discussing the formation of the program and confirming grant project milestones, Agatha would say, "Rick would know" [Interview, 091412] or Rick would say "I'd have to talk to Gus about that to see what he remembers." [Interview, 083112]. Peers provided a source of institutional memory for the events of the community.

Each of these artifacts was also important to documenting the work of the curriculum for replication in the future. These artifacts would be available to communicate curricular knowledge and practices to new members of the community in the future. Existing models and approaches to faculty development failed to account for "the power of communities for supporting and strengthening instruction in the workplace" (O'Sullivan & Irby, 2011, p. 425). The results of this study contributes to faculty development research by providing some evidence that through the community, faculty participants reported and were observed developing their instructional skills and experimenting with new instructional approaches. Faculty collaboratively confronted and reflected on the problems that arose during the curriculum implementation.

Within a community of practice, participants gain expertise through the process of *legitimate peripheral participation* (Lave & Wenger, 1991). Legitimate peripheral participation is a process where newcomers are acculturated into the community, its ways of acting and performing, of knowledge and skill; and a way to explain "the relationships between newcomers and old timers" (Lave & Wenger, 1991, p. 29). There are limits to the explanatory strength to a community of practice theoretical frame and the concept of *legitimate peripheral participation.*

In this faculty community, all members started interacting at roughly the same time. While Rick was an old timer in the sense of his experience managing a doctoral program, he was a novice in instructional design and methods. The entire faculty was inexperienced with curricular implementation, so the concept that there would be a part of the community that were old timers inculcating the newcomers into the practices and culture of the community was moot.

Other parallel interpretations of *legitimate peripheral participation* were considered to explain learning through the faculty community. First, a view where the faculty members were outsiders to the translational sciences community and through their membership in directing a translationally oriented graduate program, they would slowly gain entry into the translational science community, as would their students.

Similarly to the way company culture is perpetuated in organizations could be another parallel interpretation (See Schein, 1984). As applicants are hired into organizations, initially the language and norms of workplace practices are unknown to the new hires. Members in the new employee's department or workspace share stories,

history, and the language of the community with the new employee until they, too, share in those same cultural and historical artifacts. New hires observe visual artifacts such as dress codes, schedules, or expressed opinions about the company. Once inculcated, these perpetuate the practices and culture of the organization.

Faculty community could develop in a similar manner. Each faculty member comes from a different department and research area. The faculty community forms the organization. As the members work together they establish the culture of the community, the language and history of the community through common implementation experiences. As new faculty join the community the founding faculty would pass on these norms, values, and artifacts of the community.

In applying community of practice theory and legitimate peripheral participation in this study of faculty community, its explanatory power remains unresolved and bears further consideration. If one holds the view that legitimate peripheral participation is inseparable from a community of practice by definition, then legitimate peripheral participation is not directly applicable to a bounded faculty practice community where peers are learning from one another. A discussion of collaborative learning theory in the professions (Johnson, Johnson, & Smith, 2007) or activity systems theory (Engestrom, 1994, 2001) may be a useful learning theory to explore.

In short, activity systems theory considers five principles that may account for learning in faculty communities:

1. Individual and group actions are understood when considered against an entire system of activity.

2. Multiple voices, views, traditions, and interests provide a source of difficulty in negotiating meaning but ultimately, this multiplicity can spur innovation.
3. The system takes shape and transforms overtime.
4. Contradictions ultimately develop. An activity system is an open system that can be disturbed by external factors and this tension creates change.
5. There is a long cycle of qualitative transformation. Participants may begin to deviate from established norms of the group on the road to a collective journey across the *zone of proximal development* (Engestrom, 2001, p. 136-137).

Reflections on Collaborative Reflection.

This study provided evidence that numerous experiences at the technical and practical levels of reflection may support the progression towards being critically reflective, being critically reflective was not instantaneous for faculty, or I would argue, not always necessary. Learning to teach is a career long pursuit (Zeichner, 1994).

It is important to note that this study was not concerned with whether or not faculty knew how to reflect. Rather, it was concerned with the degree to which collaborative reflections on actions of the community helped the community adapt over time to the work required of curricular innovation. Peer meetings may naturally stimulate or promote collaborative reflective practice through everyday dialogue and negotiation of the work. Consistent with the Tigelaar and colleagues (2008) study of collaborative reflection of faculty in meetings, faculty were experienced faculty. Gus and Agatha's prior participation in faculty development activities also meant they were exposed to the process of reflection through that formal training.

The study provided evidence consistent with Kreber's (2005) model of reflection on higher education science teaching. The faculty community was focused more on

content and process reflection, as opposed to premise, or what is considered higher and more critical levels of reflection (Mezirow, 1990, 1991). As indicated in the results section, instructional content and process, pedagogical content and process, and curricular content were the focal points of collaborative reflection in this faculty community. Concurring with Zeichner (1994), I would not interpret this as a negative outcome. As Van Manen (1977) suggested, in curricular implementation, there are technical and practical concerns of teaching. Over time, faculty did reach more critical levels of reflection on their teaching. Faculty members appropriated the use of inquiry-based instructional methods. The view that there was no other way and these views of instruction varied from their novice views of the curricular implementation experience.

Because this study is about how a faculty community used reflection to advance their understanding of a curricular implementation, I anticipated that the outcomes of participation in faculty community could include one or more of these five outcomes from thirty prior studies of reflection in faculty development:

1. Change in individual teacher's conceptions of teaching and learning
2. Reflections for conceptual change leading to changes in teaching practice
3. Activities to prompt and support individual reflection
4. Including a collegial element to aid individual reflection
5. Assessment of intervention impact based on individual change in conceptions about teaching and learning (Amundsen & Wilson, 2012, p. 98)

This research revealed that faculty changed their individual conceptions of teaching, changed their practice of teaching graduate biomedical students, and collaboration on a curriculum project provided activities around which to engage and support reflection on the work of the community.

Limitations

Limitations to the study are discussed in this section include field notebook condition, maturation effects due to longevity of the study, observer effects, settings of observations, and understanding clinical and biomedical terminology. In this section, I will address these and other methodological criticisms of ethnography, including subjectivity in the process contributing to issues with reliability and validity and a lack of generalizability (LeCompte & Goetz, 1982).

Field Notebooks and Memos. While I was embedded with community at the start of the program implementation, my interest in examining faculty as a community case study evolved after working with them for a few months as a program evaluator. Consistent with the ethnographic method, data gathering may precede hypothesis generation (LeCompte & Goetz, 1982); therefore, it could not be expected that my initial observational notes would provide elaborate documentation of reflective conversations between faculty during meetings. My early notes in the first semester weeks were cryptic and sometimes tangential.

Data transcription of the observational field notebooks into a computer word document format was not completed. Transcription of my observations may have assisted in the recall of the more detailed faculty communications; however, it was not a significant concern. These early notes were good documentation of the flow of work, the structure and frequency of interactions, as well as my impressions about early program experiences.

Maturation. The loss of immediacy of the experience due to the duration of a study may have created a potential threat. Maturation is the natural development and change that takes place over time in individuals. The episodic timeline analysis is provided to demonstrate baseline activities and then over time how new types of episodes become the focus of community reflections. I aimed to provide the reader with both micro and macro level views of the community's work.

Limited Context. As a qualitative study, the experiences of faculty decribed in this study are subject to the reader's interpretation of their value, merit, and strength for applicability in their own settings. Further, these conclusions are bounded by the context of the study and the organizational structure within which it was conducted. The particular human experiences of the program implementation may not be replicated; it would be impossible to reproduce the circumstances and events of the community.

The study did not include an examination of faculty in their research laboratories, or on other advisory committees in the university. While I was provided a tour of two laboratory facilities, I did not observe faculty in the context of their research work. My observations were focused primarily on examining faculty in the context of the program implementation and matters related to it, during meetings and classroom instruction. While I was able to observe autopsy specimens during an instructional activity for PTSC 4, this was still removed from the day-to-day work of autopsy performance by one faculty member. This may or may not have provided additional insight into the nature of faculty development through interaction with non-community member colleagues.

Trustworthiness. The systematic analysis methods used in this study, prolonged engagement, peer debriefing, and member-checking are used to establish credibility, dependability and, ultimately, a degree of trustworthiness in its conclusions. Multiple methods were used in an effort to increase trustworthiness of the results.

Member-checking was used at several points in the data analysis process, so that if faculty disagreed with results of the study, there was ample opportunity for them to inform me that a particular result was inaccurately interpreted.

Researcher Effects. I brought an educational and organizational science perspective to the work of program evaluation. While faculty each felt that hiring me into the program was one of three key decisions they made in the program, as an educational observer, I believe the main impact of my participation was to provide a measure of educational confidence or credibility to their work. Rick expressed his concern for having other members of the institution take the program seriously and because its methods were unconventional, an educator in part, validated their innovative effort. I never felt or believed I added anything substantive to the work of the faculty; I did not interfere with their teaching. They made decisions about what was right for the classroom, including assessments, course activities, and materials.

The tools, artifacts, and processes of the community were developed in response to the problems of practicing faculty, when they felt disequilibrium or misalignment between the goals for the program and how the day-to-day tasks of the program were operationalized. As evidenced in the episodes, faculty discussed these issues in meetings when they were confronted with the problems none had previously experienced.

When they made observations of their own teaching or student learning, if asked, I provided my feedback. I was an administrator who also had to remain a balanced evaluator. In this sense, I did provide faculty with formative data on which to base their decision-making, however, I did not make program decisions.

I was responsible for providing formative or developmental program evaluation data to faculty in the form of summaries of course evaluations, aggregated summaries of student interviews, and the documentation of the program development. Through these activities, I may have influenced faculty learning indirectly or directly. As a model for workplace based faculty development, the effects of embedding an educator in a faculty community longitudinally will need to be studied further.

Conclusion

It has been thirty-three years since Miller's (1980) book on educating physicians recognizing the importance of pedagogical expertise in medical education and it has been fifty-eight years since the Buffalo program in faculty development in medical education. Centra's (1976) landmark study in faculty development was just forty years ago. It is clear from reviews of faculty development literature that there is tremendous opportunity to explore new ways of supporting faculty on their career journeys in teaching, instruction, assessment, and leadership.

This research sought to explore the role of collaborative reflection for advancing faculty members' understanding of an innovative curriculum implementation. The central hypothesis was that faculty communities that systematically reflected on their collective practice would learn. The results described the types of activities or episodes that were

observed and reported as triggers for collaborative reflection, how the episodes unfolded over time, and how community membership supported the development of individual faculty members. Collaborative reflection in this faculty community promoted faculty learning over time in several areas including: teaching and instruction, assessment and evaluation, individual knowledge, student learning, and organizational and leadership skills.

Collaborative reflection occurred in response to multiple episodes that occurred during curriculum implementation, but was focused primarily on facets of instruction, which was the dominant work of the community. Collaborative reflection enabled decision-making on instructional content and process, pedagogical content and process, and curricular content. A cyclical process of instructional development emerged in the community including: session planning, implementation, collective teaching observation, and collective instructional evaluation. Attributes of the community that emerged to support collaborative reflection included: shared goals, domain knowledge, and mutual trust. The community provided a shared social context for systematic collaborative reflection and scaffolding in instructional development.

Given the results of the study and the role of peer observation and feedback in the instructional development process of the faculty community, future research will focus on testing and validating the collaborative instructional development model proposed here in the context of the peer observation literature. I will also expand the idea of a situational faculty development approach. This further work could determine if the instructional

development process proposed would be an effective model for future faculty development workplace-based consultations in the future.

Glossary

American Medical Association (AMA): The largest professional association of doctors founded in 1847. (www.ama-assn.org)

American Association of Medical Colleges (AAMC): A not for profit association representing 141 US and 17 Canadian academic medical schools, major teaching hospitals and health systems, veteran's affairs medical centers, and 90 academic and scientific societies, founded in 1876. (www.aamc.org/about/).

Clerkship: the third and forth years of medical school primarily focused on clinical experiences in hospitals and ambulatory settings.

Cohort-based faculty community: a group of faculty that are of similar level or position within higher education.

Competency based education (CBE): education that is derived from a model of the "ideal" professional outcome and then educational experiences are designed to attain this ideal end state.

Discipline-based clerkship: focus on medical specialty rotations in surgery, internal medicine, pediatrics, obstetrics, and gynecology.

Faculty development: (also, educational, professional, or staff development): faculty development broadly encompasses all the activities that assist faculty in the performance of their duties along the career continuum from entry-level faculty orientation and teaching improvement activities, to personal development, organizational development (e.g. continuous institutional learning through shared values and mission), and mid-or late career activities that focus on renewal or faculty vitality.

Faculty learning community (FLC): a "cross-disciplinary faculty and staff group of six to fifteen members (usually 8-12 members) who engage in an active, collaborative year-

long program with a curriculum about enhancing teaching and learning and with frequent seminars and activities

Faculty thinking community (FTC): faculty who self-select to work with a group of peers; emphasize reflection on members' underlying assumptions about their academic roles and aim to nurture knowledge creation and creativity.

Graduate medical education (GME): The period of training after completing undergraduate medical education.

Institute of Medicine (IOM): The Institute of Medicine is the healthcare segment of the National Academy of Sciences; provides health related evidence to government and the public. (www.iom.edu)

Integrated medical curriculum: Learning of medical topics and cases is not segmented; rather multiple facets of disease may be covered in one class.

Microteaching: a teaching development process where a faculty member practices a skill, applies the skill for a short period of time (10 minutes) while being videotaped, then reviews the tape with a peer or supervisor for feedback and discussion.

Longitudinal clerkship curriculum: progressively developmental, students spend six months to a year with faculty, rather than rotating through each specialty.

Multidisciplinary Translational Teams (MTTs): teams of scientists, chemists, biostatisticians, and physicians working on healthcare related research.

Mixed-model clerkship curriculum: includes student assignments to multiple specialty rotations, also assignment to a single faculty over the duration.

National Board of Medical Examiners (NBME): provides testing and oversight of testing for licensure for physicians and medical students.

Organ systems-based curriculum: medical school curriculum designed around each major human organ system.

Preceptorship: Mentors in clinical experiences.

Pre-Clerkship: the first and second year of medical school primarily focused on basic sciences education.

Professional learning community (PLC): A learning community focused on developing professionalism sills, usually in K-12 schools.

Problem-based learning (PBL): PBL is a small group-based instructional method requiring learners to explore a patient case in incremental parts over several classes, while developing a list of facts, hypotheses, learning issues, and additional information needed to accurately make a diagnosis

Process Oriented Guided Inquiry learning (POGIL): an instructional method used in chemistry and science classrooms that requires students to work through guided questions and data analyses to arrive at scientific understanding.

Rounds: the daily patient visits a physician makes to those patients under his or her care.

Topic-based faculty community: Faculty community that works together on a shared topic of interest like technology in teaching.

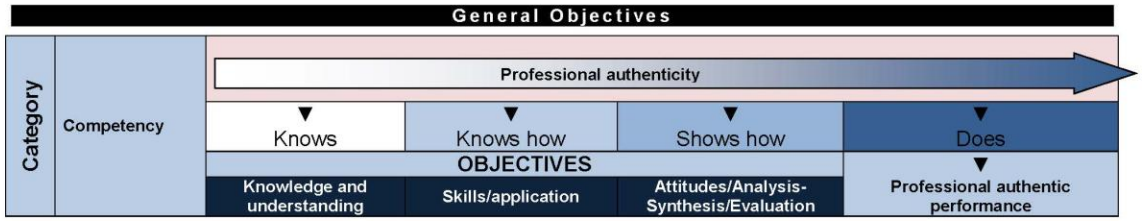
Translational sciences: Translational sciences education aims to enhance the collaborations between scientists and clinicians for the advancement of patient treatment and care.

Undergraduate Medical Education (UME): the four years of medical school completed after a bachelor's degree in the sciences.

United States Medical Licensing Examination (USMLE) and Step 1, 2, 3: Licensing assessment along undergraduate medical education process

Appendices

Appendix A



	Competency	Knowledge and understanding	Skills/application	Attitudes/Analysis-Synthesis/Evaluation	Authentic performance
Science content	Proficient Subject knowledge	Knows content			Knows background subjects that support, even peripherally, the area of research
	Broad understanding of the normal structure and function of the human body	Knowledgeable in molecular biochemical and cellular mechanisms important in maintaining physiological homeostasis of organisms			
	Broad understanding of alterations in structure and function of the body and its major organ systems that correlate to specific human disease and/or injury				
	Appreciates limitations of current standards of care for human disease				

Appendix A

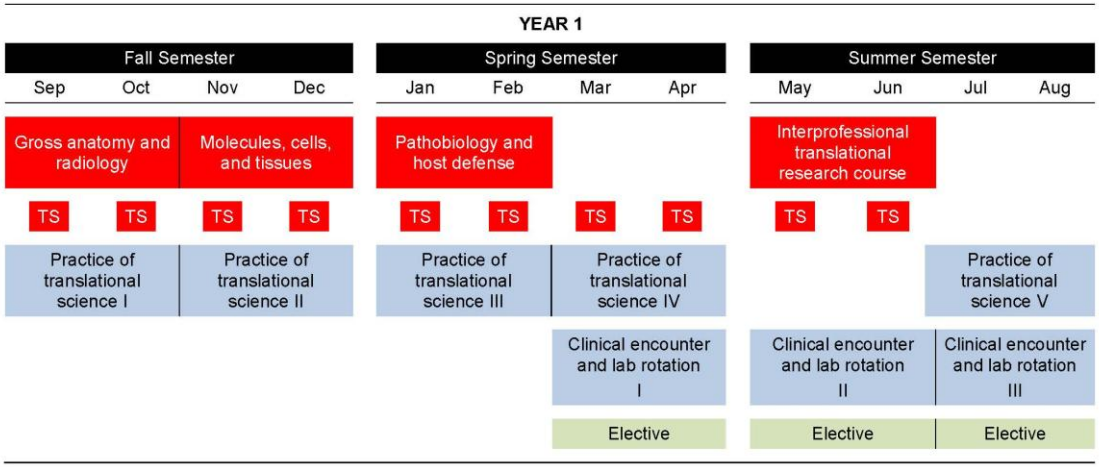
	Competency	Knowledge and understanding	Skills/application	Attitudes/Analysis-Synthesis/Evaluation	Authentic performance
Personal and professional characteristics / professionalism	Awareness of role in the biomedical field	Knowing what translational scientists can do that physicians cannot do and viceversa. Understands their unique role and society's expectations			Honors the expectations of the university, the profession, and the public
					•Work as a leader of a multidisciplinary research team
		Knows sources of science policy information. Knows current issues and areas of debate.	Discusses, with informed opinions, and establishes a clear position		Adopts a position in regards to science policy issues.
	Self-awareness	Know their own learning style, personality, sleep needs, ways of improving learning	Self-assessment	Awareness of own strengths and weaknesses	Recognizes personal and professional limits.
					Identifies personal limits and areas of growth
	Adaptability	Knows psychology/sociology of change.		Awareness of own adaptability traits	Adapts to changes in job environment, methods, regulations, surroundings, etc.
	Dependability			Awareness of own traits	Takes on responsibilities and is accountable for them.
	Initiative and Resourcefulness	Knows psychology of originality, etc???			Contributes, develops, and/or carries out new ideas or methods.
	Positive Interpersonal Relationships	Knows psychological aspects.		Empathy	Works effectively with others and treats others with courtesy and respect
				Displays guiding vs. imparting communication style	respects, evaluates, and enhances the intellectual contribution of others by encouraging nourishing attitudes and relationships
	Good judgment	See management.	Assesses and upholds workplace etiquette, performance standards, and project goals with members of a research team		Decides correct or best course of action when some choice must be made
	Positive personal qualities				exemplifies the virtues of honor, integrity, compassion, cooperation, reliability, and responsibility
		Knows strategies			commits to a path of lifelong learning by expanding personal skills and interests

Appendix A

Competency		Knowledge and understanding	Skills/application	Attitudes/Analysis-Synthesis/Evaluation	Authentic performance
Communication	Appropriate communi-cation skills	Knows elements of style			Writes about science topics for lay public using an effective style.
		Knows medical terminology	•Clarify language differences across disciplines	Understands and uses medical jargon	Communicates effectively with health professionals
			Effectively communicates with colleagues at all levels so as to advance their daily work	•Translate clinical and translational research findings into national health strategies or guidelines for use by the general public	•Translate the implications of clinical and translational research findings for clinical practice, advocacy, and governmental groups
			•Write summaries of scientific information for use in the development of clinical health care policy		
		Knows techniques for effective presentations		Develops confidence in expressing one's attitudes, observations, or opinions using positive or reinforcing language	•Communicate clinical and translational research findings to different groups of individuals, including colleagues, students, the lay public, and the media
		Knows psychology	•Differentiate between cultural competency and cultural sensitivity principles	•Demonstrate group decision-making techniques	Works effectively with individuals with different temperament traits
		Knows techniques to deal with conflict	•Advocate for multiple points of view	Listens and Provides feedback	Manages conflict and difficult conversations appropriately
				Listens and generates a plan to respond to assessment	Responds constructively to the outcome of assessments and reviews
		•Examine the characteristics that bind people together as a community, including social ties, common perspectives or interests, and geography	•Appraise the role of community engagement as a strategy for identifying community health issues, translating health research to communities and reducing health disparities		

Appendix B

Human Pathophysiology and Translational Medicine (HPTM) Program



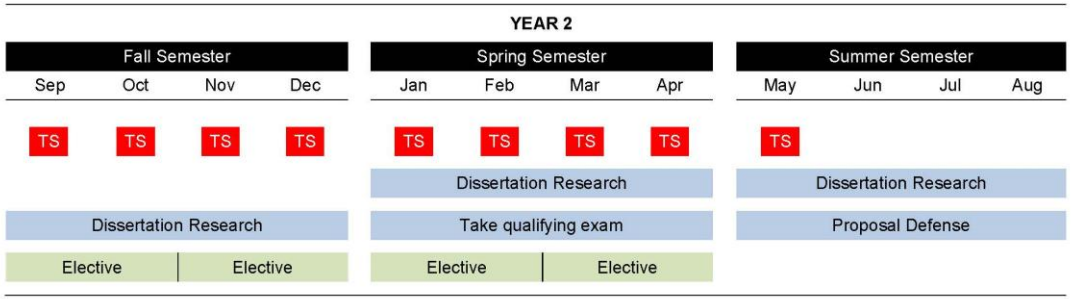
Color code

- Joint HPTM/School of Medicine inter-professional courses
- HPTM- program-specific courses
- GSBS Electives

Abbreviations

TS: Topics in Translational Research Seminar series

Appendix B


YEAR 2
Fall Semester
Spring Semester
Summer Semester
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
TS
TS
TS
TS
TS
TS
TS
TS
TS
Dissertation Research
Dissertation Research
Dissertation Research
Take qualifying exam
Proposal Defense
Elective
Elective
Elective
Elective

Appendix C

POTS1, Cardiovascular Physiology I

Objectives

1.

Pre-Class reading assignment:

Guyton and Hall, Textbook of Medical Physiology, 12th edition

Chapter 14: Overview of the circulation; Biophysics of pressure, flow, and resistance (pp 157-166)

Cahpter 15: Vascular distensibility and functions of the arterial and venous systems (pp 167-176)

Chapter 17: Local and humoral control of tissue blood flow (pp 191-200)

Please try to address all three levels of objectives below but certainly no less than two:

A. For Knowledge and understanding:

Learning goal	Assessment	Activity	Rationale for alignment of goal, activity, and assessment

B. For skills and/or application:

Learning goal	Activity	Assessment	Rationale for alignment of goal, activity, and assessment

C. For attitudes, synthesis, evaluation, analysis, or performance:

Learning goal	Activity	Assessment	Rationale for alignment of goal, activity, and assessment

Other important considerations

- It is desirable to produce a concept map so that students can contrast with their own concept map. This is important because knowledge organization influences learning and performance. Student's initial organization is most frequently sparsely connected while the expert's organization is richly connected. If students become aware of how interconnected knowledge can be, they will be able to learn more effectively and efficiently.
- Make explicit connections to students' interests or highlight why they should be interested (e.g., in terms of relevance to their professional life). This is important because this is an integral aspect of motivation. If you provide real-world tasks, students will discover that connection. Also, showing your passion and enthusiasm for the discipline will help a great deal. Tell them why you love the subject.

- For any assignment, make sure that you provide performance criteria in the form of checklists or in the form of rubrics (a representation of performance expectations).
- Provide questions that facilitate reflection on the assignments and the student's performance (e.g., what did you learn?, what was the most valuable feature of the assignment or project?, how did you prepare?, how can you improve?, what skills do you need to work on?, if you were to do it again, how would you do it?).
- Provide student's with opportunities or specific questions that allow them to make generalizations from the particular problem or activity that they are working on.
- Plan your time and let student's know the amount of time that an assignment may require. As a rule of thumb, student's take about four times as long as the faculty.
- If possible, provide specific examples of what is low- and high-quality work.
- If available, provide simple heuristics for self-correction

Teaching plan

Pre-class activities

- Readings:
  - XX
  - XX
- Ask students to list concepts that they found particularly challenging.
- Ask students to list misconceptions that they identified.
- Ask students to create a concept map representing previous and current knowledge about the topic. This construction will be continued during and after class.
- Other
  - XX
  - XX

In class activities (including estimated time and instructions)

- Address material that students found particularly challenging or even confusing.
- XXX

Appendix D

Examples of Classroom Planning Documents

Planning Doc Feb 7+9, Influenza

OBJECTIVES: Science content competencies:

1. Compare clinical and pathological features of severe influenza infections caused by H5N1, 1918 H1N1 and 2009 H1N1 strains
2. Explain concepts of reassortment, genetic shift, and genetic drift and relate to influenza virus nomenclature and pathogenesis
3. Outline the process of "reverse genetics" for the study of viral pathogenesis, with specific reference to influenza
4. List the steps in infectious disease pathogenesis as outlined by Mims and relate to influenza virus pathogenesis
5. Explore concepts of viral host range specificity and cellular tropisms and relate to transmission and maintenance in nature
6. Relate innate immune responses to severe influenza pathogenesis and describe supporting experimental data leading to the derivation of these pathogenic hypotheses

Non content competencies:

7. Team work: recognize and value contributions of others, provide input on group work, identify and perform role in team, reflect on team function and input of members, peer assess contributions
8. Scientific reasoning: evaluate graphically displayed data , anticipate next question in logical approaches to research question, determine appropriateness of methodology used to approach research question
9. Life long learning: Identify gaps in personal knowledge base and create specific plan to address this.
10. Teaching: Share knowledge in the group, explain concepts to others.
11. Communication: Present oral arguments based on research in role playing debate format.
12. External services: Discuss and considerations behind recent recommendation to curtail publication of experimental details regarding H5N1 virulence features—ie balancing public health with communication among scientists

Resources (see file)

Debate

Appendix D

Examples of Classroom Planning Documents

http://www.nytimes.com/2011/12/27/science/debate-persists-on-deadly-flu-made-airborne.html?pagewanted=all

A. For knowledge and understanding:

Learning goal	Assessment	Activity	Explanation of alignment of 3 prior
1	Quiz; POGIL write-up; Debate	POGIL exercise; pre-class reading; Debate	
2, 4	POGIL group write-up	POGIl exercise and mini-lecture	
3,5	POGIL group write-up, quiz, consider for final exam	POGIL, debate, assigned reading	
6	Quiz	Assigned reading, pre-class	

B. For skills and/or application

Learning goal	Assessment	Activity	Explanation of alignment
1,2,3,5	Demonstration of understanding of these concepts in debate argument	Debate and prep	
7,10	Small group evaluation rubric (MH and JA)	POGIL exercise	
8	POGIL write-up	POGIL	
11	POGIL small group evaluation; Debate rubric (TBD)	Debate, POGIL exercise	
9	Recorded questions on white board.....	POGIL Questioner role	
12	Debate, presentation rubric and write-up rubric (TBD)	Debate	

Appendix D

Examples of Classroom Planning Documents

C. For attitudes, synthesis, evaluation, analysis, or performance

Learning Goal	Assessment	Activity	Explanation of alignment
3,5,11,12	Debate oral and write-up rubric; facilitated reflection as group	Debate	

Appendix D

Examples of Classroom Planning Documents

Pre-class assignment (for Feb 7):

1. Read review article, Peiris JSM et al, Host response to influenza virus: protection versus immunopathology, Curr Opinion in Immunology 2010 22:475-481 (purpose—overview of pandemic strains, pathology and pathogenesis. Will put H5N1 in context)

In class, Tuesday (see POGIL exercise document)

1. Mini-lecture, Mims pathogenesis scheme (is this review)
2. Address two aspects in class: receptor binding (watanabe); spread within host (fouchier)
3. Additional points: reverse genetics, animal models, genetic drift
4. This should set up nicely for Thursday debate—ie what viral features promote H5N1 transmission, could be accessible by reverse genetics approaches.....

Pre-class assignment (For Feb 9):

1. Read Kitaly review, reverse genetics and articles from Tuesday
2. Read background information from lay press and other sources to prepare for role in debate
3. Write-up, to be turned in at end of debate: three major points to be made in argument plus list of resources used.
4. See debate instructions for additional info

In class activity (Feb 9)

1. Debate, role playing, roles determined by students. Topic is whether details of scientific experiments involving H5N1 should be withheld from published articles
2. Structured format, includes audience questions (consider role-playing lay population)
3. Facilitated reflection at end, moderated by XX, input from others.

Appendix D

Examples of Classroom Planning Documents

1: Week 7 "The public health perspective of medicine"

Tuesday October 11, 2011

Objectives:

- Define public health and be familiar with basic approaches and terms in epidemiology.
- Appreciate role of epidemiological studies in control and understanding of disease. Appreciate through historical context contributions of epidemiology to understanding of and amelioration of disease
- Define epidemiology and state goals of epidemiological studies/approaches
- Assess epidemiologic approaches to research questions. Compare and contrast with laboratory based approaches.
- Utilize epidemiologic information to develop a translational research question.

Pre-class reading :

1. Review Introduction to Epidemiology powerpoint. Understanding_Epidemiology-Epidemiology_Basics[1].pptx
2. Read Chapter 1, "Historical Development", Lee et al, Principles and Practice of Public Health Surveillance Lee et al chapter 1 surveillance.pdf

Pre-class Assignment:

1. Find a definition of public health. Bring a written copy of definition, with the citation/source to class. Be prepared to explain and share with class. What does public health have to do with your future career?
    a. Grading rubric: 1) answers all three parts (definition, citation, reflection), legibly, clearly expressed, appropriate to question)=100% 2) appropriately answers subparts 1 and 3, but no citation included 80% 3) appropriately answers subparts 1 and 2, but no reflection (70%) 4) did not complete assignment or shows insufficient effort (Fail)

Appendix D

Examples of Classroom Planning Documents

In class: The Public Health Perspective.ppt

1. R to Prompt students. What topics did they pick for their literature search? (10 minutes)
2. Quiz (10 minutes) Quiz.doc
    - Grading rub ric:
3. Discuss definitions of public health. A to facilitate. Bring out major themes. Ask students to consider what it has to do with translational research. Translational research spectrum diagram (5 minutes)
4. Review WHO statistics—top 10 causes of death worldwide and by income group . Discussion points: Do you see differences in COD between countries classified based on income? Rationale for classifying based on income? Is there anything in this list that surprises you? (10 minutes)

   http://www.who.int/mediacentre/factsheets/fs310/en/index.html
5. Shift gears, brief biographical video of an important figure in public health. View Ancel Keys video (20 minutes—Debrief 20 minutes). Provide worksheet to promote active listening.

   http://www.asph.org/document.cfm?page=793

    - Describe study design for CHD risk factors or 7 country study, as described. Checklist:
        - Experimental
        - Observational
        - Descriptive
        - Analytical
    - Which was (were) the primary focus of Dr Keys' studies: Individual, "agent" or environment? [on the triangle diagram, indicate which elements were the focus of each study]
    - How would you describe the "public health impact" of Dr. Keys work? Do you think his work had any effect on mortality from cardiovascular disease?
    - From the video, what impressed you most about Dr Keys? What biographical aspect resonated with you?

Appendix D

Examples of Classroom Planning Documents

- Debrief. In class Worksheet.doc
- Show age-adjusted death rates from 1950's to 2007. Declining rates of fatal heart disease.

Take a break

6. Discuss in class a paper from Keys "Mortality and coronary heart disease among men studied for 23 years" Arch Int Med 128(2):201 (1971). [students work on their own for 15 minutes, 5 minute mini-lecture, 5 minute finish activity=25 minutes total.] Keys CHD 23 yrs.pdf
   - What is the goal of the study?
   - Who were the study subjects and how were they identified/recruited?
   - List the "variables" they considered as possible causative factors in the genesis of CHD.
   - Would you consider this an observational or experimental study? If observational, is it descriptive or analytical?
   - worksheet 2.doc
   - **Mini-lecture:** Clinical study design; multivariate analysis. Show diagrams from Dawson book. 2-2 (cross-sectional); 2-3 (cohort); 2-4 historical cohort; Experimental RCT 2-6.
   - Which most resembles this study? Which most resembles bench studies that you do in the lab? How do they differ?
7. Mini-lecture: *C. Trachomatis*. Look at data from STD surveillance for Chlamydia. (ppt) What are some possible contributions to changing incidence/prevalence of C Trachomatis? Propose at least one from host, agent, environment category. What additional information do you need?
8. Can you develop a basic science (T1) research question based on these data? Do lit search to identify at least one relevant article—working together in class? Or search independently and share. (turn in question, search, and article summary for grade next session)
   - Grading rubric:
     - **Translational related question,** derived from epidemiologic data (100%=complete, responsive, clear; 80%= not T1 translational or link fromepidemiologic data not explicit, or not clearly stated; 70% insufficient effort shown)
     - **Search strategy:** 100%=appropriate, logical; 80% not responsive, 70% not done

Appendix D

Examples of Classroom Planning Documents

- **Article identification and summary:** 100%, T1 related article clearly and concisely explained, accurate (based on grader review of abstract); 80% article not at T1 level, patient or population based, T1 issue not identified OR article otherwise not responsive, or smmary of article not clear or not completely accurate; 70% insufficient effort shown. No search done, no search strategy included

Appendix D

Examples of Classroom Planning Documents

Level	Goal	Activity	Assessment	Rationale, alignment of goal, activity, assessment
Knowledge and understanding	Define public health and be familiar with basic approaches and terms in epidemiology.	Review powerpoint, intro to epidemiology; find and discuss definitions of public health; read chapter on history of surveillance	Pre-session quiz; turn in definition of public health	
	Define epidemiology and state goals of epidemiological studies/approaches	In class mini-lecture on study design; identify study design types	Class room participation	
Skills/application	Assess epidemiologic approaches to research questions. Compare and contrast with laboratory based approaches.	In class exercise to identify study design types	Class room participation	
	Utilize epidemiologic information to develop a translational research question.	In class and take home assignment; identify research question based on epidemiologic data	Lit search and article summary	

Appendix D

Examples of Classroom Planning Documents

Attitudes, synthesis, evaluation	Appreciate role of epidemiological studies in control and understanding of disease. Appreciate through historical context contributions of epidemiology to understanding of and amelioration of disease	View video bio of Ancel Keys, epidemiologic data on CHD. Discuss personal perception of historical contribution	Classroom participation	

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

Chlamydia persistence:

Pre-class assignment: Beatty et al, "Persistent chlamydiae: from cell culture to a paradigm for chlamydial pathogenesis" Micribiol Rev 1994. 58(4):686-699

Basis for discussion: Roth et al, "Hypoxia abrogates antichlamydial properties of IFNg in hman fallopian tube cells in vitro and ex vivo."

Resources:

http://kinase.uhnres.utoronto.ca/signallingmap.html

You Tube video, chronic salpingitis (emailed myself the link). This is 2:48 long

<iframe width="420" height="315" src="http://www.youtube.com/embed/VS9WqzRQp5k" frameborder="0" allowfullscreen></iframe>

Abbas, edition 6, Figure Box 12-2 Jak=-STAT pathway signaling. Check student consult.

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

Objectives: At the conclusion of the assigned reading and this session, students should be able to:

1. Describe the life cycle of *Chlamydia trachomatis* and morphologic hallmarks of various stages. Explain what is meant by "persistence' in chlamydial infections.
2. Relate some aspects of chlamydial biology to the diseases caused in humans.
3. Diagram a canonical interferon gamma signaling pathway. Relate to effector mechanisms of this cytokine in chlamydial growth control.
4. Practice cooperative group work to analyze data from the primary literature in the context of a stated hypothesis.
5. Identify "translational" limitations in experimental design.
6. Identify gaps in personal knowledge and strategies for addressing these.

Session plan:

1. Quiz (5 minutes)
2. Describe procedure, assign roles ([redacted] recorder, [redacted] manager, [redacted] reflector, [redacted] reporter) (5 min)
3. Allow 10 minutes for questions 1-4. Then debrief/discuss (5 minutes)
4. Allow 25 minutes for questions 5-7. Then debrief/discuss (5 minutes) [break if needed?]
5. Mini-lecture, [redacted], Jak-STAT, 5 min
6. Allow 30 minutes for questions 8-10. Then debrief (5 minutes).
7. Allow 10 minutes for question 11. Discuss, 5 minutes.
8. Each group member completes reflection questions (10 minutes)
9. Turn in: Group paper [redacted] recorder). (group grade). Reflection (credit for doing, not graded).

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

1. Chlamydia trachomatis is an important sexually transmitted pathogen that can cause infertility, pelvic inflammatory disease, ectopic pregnancy, among other problems. In women, chlamydia infection can involve the uterine cervix, endometrial cavity, fallopian tubes. Locate and label each of these regions on the image.

2. Chlamydia infects epithelial cells of the endocervix, endometrium, and Fallopian tubes. On the image of Fallopian tube, can you identify which cells are the epithelial cells? Note the surface specialization, the cilia. How might these contribute to tubal function?

3. During chronic chlamydial salpingitis (inflammation of the fallopian tube), there is a strong inflammatory reaction in the subepithelial connective tissue, dominated by lymphocytes and plasma cells. Compare the images of normal fallopian tube and chronic salpingitis on the image. Point out epithelium, subepithelial connective tissue and inflammatory infiltrate.

4. Ectopic pregnancy is a potentially fatal complication of chronic salpingitis. Review the animated illustration of what happens in ectopic pregnancy. In general terms, how could the pathology above lead to ectopic pregnancy? What types of changes in the tissue could pre-dispose to ectopic pregnancy? (4 minutes)

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

5. As you have learned from your reading, *Chlamydia trachomatis* is capable of causing long-standing chronic infections, apparently in part by its capability to persist in infected tissues in a non-cultivable, "latency-like" form. A conundrum is that organisms that are truly "latent" and metabolically inert should not cause inflammatory reaction. How then do these organisms cause chronic infection with inflammation and scarring? Many have theorized that there must be some mechanism by which the Chlamydial organisms can be "re-animated" (not a scientific term!), revert to actively growing form that stimulates immune and inflammatory responses. In a recent article by Anna Roth et al, the authors hypothesized that "an environmental factor in the urogenital tract might cause the reversion from persistent to actively growing chlamydiae that maintain the inflammatory process". Further, since the female upper genital tract is noted to have relatively low oxygen tensions under physiological conditions, they "focused on the influence of low oxygen concentrations on IFN-γ induced chlamydial persistence". Recall (or review), from your reading, what are some effects of this cytokine on chlamydial growth. List at least three. What cells can produce IFNγ? Which cells on image 3 do you think could produce interferon gamma?

6. In the experiment shown in slide 6, investigators treated *C. trachomatis*-infected HEp-2 cells [a human epithelial cell line] with interferon gamma to induce persistence. They did this experiment under two conditions, "normoxia" (Nox 20% O_2) and "hypoxia" (Hox 2% O_2). The latter condition mimics oxygen levels thought to be present in inflamed female urogenital tract. The images demonstrate immunofluorescence staining for Chlamydia antigens in cultured cells, or transmission electron micrographs of cultured cells. Study, discuss and explain the experimental data. What are your conclusions? What other types of data would you like to see to solidify your conclusion?

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

7. In experiments as described above, the authors measured C. *trachomatis* growth as "relative infectious units" (IFU). Levels of infection were determined by detaching and suspending the infected, treated cell monolayers, and placing serial dilutions of these infected cells on a fresh, uninfected monolayer. After 30 hours of incubation, the monolayer was fixed and stained with fluorescent anti-chlamydial antibody, and the number of chlamydial inclusions was counted. In panel D, *euo, omcB* and *hctA* are chlamydial genes as indicated. mRNA expression was determined by quantitative RT-PCR. How do these results relate to those in slide 6? Discuss and write down your interpretation of these experiments and your conclusions so far.

8. [Mini-lecture by [redacted] The investigators then did experiments to determine the effect of hypoxia on specific elements of the interferon gamma signaling pathway. Many cytokine receptors signal through the Jak (Janus kinase) –STAT (signal transducer and activator of transcription) pathway. Inactive Jak enzymes are non-covalently attached to the cytoplasmic domains of the cytokine receptor; when ligand (cytokine) binds receptor, it brings adjacent receptor molecules in proximity, and trans-phosphorylation of Jak occurs. The now active Jak kinase phosphorylates tyrosine residues in the cytoplasmic domain of the cytokine receptor, and some phosphotyrosine moieties are recognized by specific domains of monomeric STAT molecules in the cytosol. As STAT binds the receptor cytoplasmic domains, it is phosphorylated by Jak, leading to dimerization of STAT, dissocation from the receptor molecule, and migration to the nucleus, where they bind promoter sequences of cytokine-responsive genes and upregulate transcription.

   For interferon gamma, CD119 is the receptor. There are a number of different STAT proteins and Jak kinases. Interferon gamma signaling utilizes primarily STAT1 and Jak1 or 2. IP-10 is an example of an interferon gamma regulated gene.

   Study the diagram in figure 8. If you wanted to measure activation of the Jak-STAT pathway, what specific molecules could you measure?

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

9. The data in panel 9 indicate how the investigators assessed IFNγ signaling in hypoxia. CD119 (IFNγ receptor) is measured by flow cytometry in panel A. Panel B shows Western blot data for indicated proteins under indicated conditions. Panel C data were obtained by quantitative RT-PCR. Explain the results. What can you conclude from these results? On the whiteboard, create a diagram of IFN signaling under normoxic conditions. You may want to use a version of the figure in slide 8 as a template. Using a different color, indicate how various steps are affected by hypoxia.

   Hypoxia-inducible factor 1α (HIF1α) is the major oxygen sensor in mammalian cells. How do the findings in panel B regarding HIFα protein levels relate to the hypothesis of the investigators?

10. IDO is another interferon-gamma regulated gene. Recall from your reading the effect of IDO on chlamydial growth. In panels D and E on slide 10, mRNA and protein levels for IDO are measured under experimental conditions in cultured cell lines infected with *C trachomatis*. What do the results tell you? How could changes in IDO expression in hypoxia relate to maintenance of persistent infection?

Appendix D

Examples of Classroom Planning Documents

POTS1, Oct 13 2011, Planning version

11. All the experiments discussed so far were conducted in an epithelial cell line derived from a human laryngeal cancer. What approaches could you think of to test the hypothesis in a system that would be relevant to the human disease?

Appendix D

Examples of Classroom Planning Documents

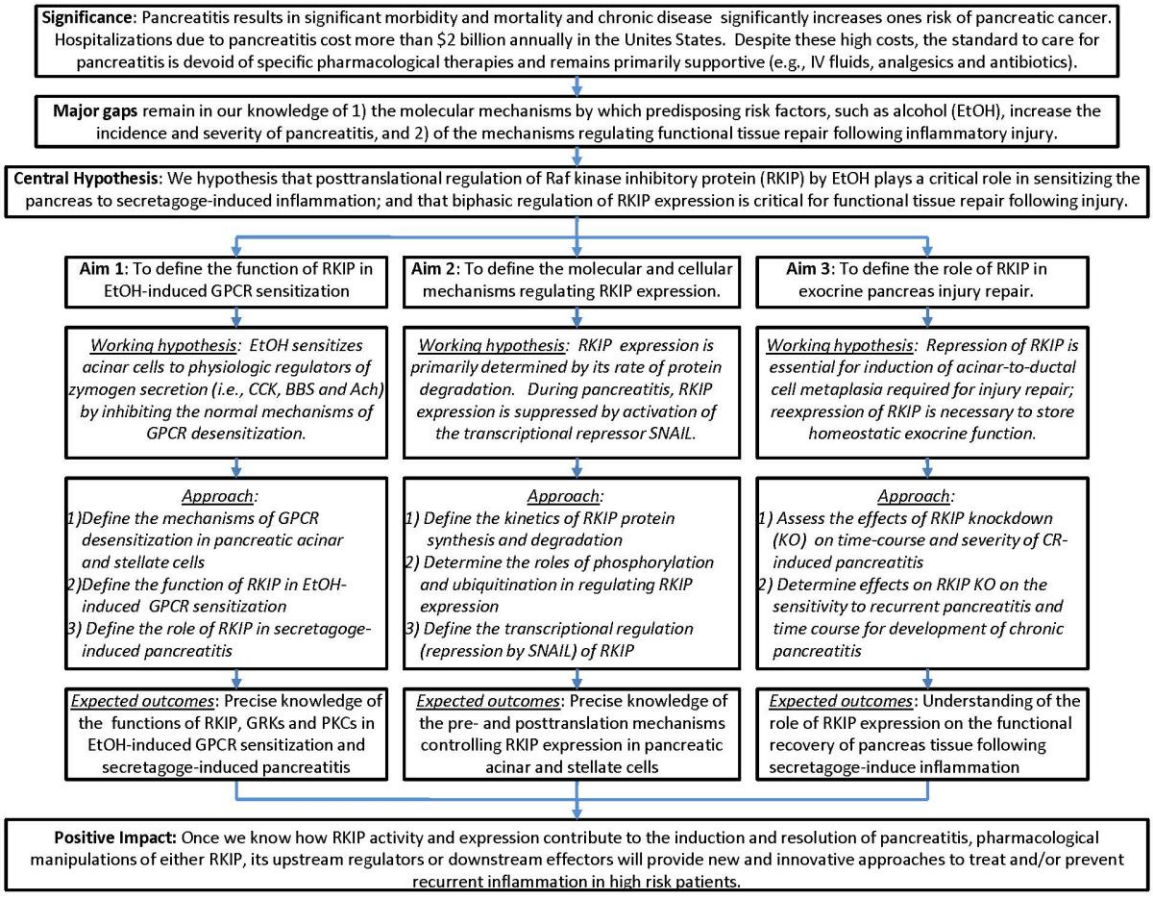
POTS1, Oct 13 2011, Planning version

Reflection (all students to complete individually)

1. **Relative to today's discussion, I feel that I want to or need to learn more about the following specific topics: (OR I have the following unanswered questions:)**

2. **Relative to today's discussion, I noticed the following overlap or connection with discussion topics from prior weeks:**

Appendix E


Significance: Pancreatitis results in significant morbidity and mortality and chronic disease significantly increases ones risk of pancreatic cancer. Hospitalizations due to pancreatitis cost more than $2 billion annually in the Unites States. Despite these high costs, the standard to care for pancreatitis is devoid of specific pharmacological therapies and remains primarily supportive (e.g., IV fluids, analgesics and antibiotics).
Major gaps remain in our knowledge of 1) the molecular mechanisms by which predisposing risk factors, such as alcohol (EtOH), increase the incidence and severity of pancreatitis, and 2) of the mechanisms regulating functional tissue repair following inflammatory injury.
Central Hypothesis: We hypothesis that posttranslational regulation of Raf kinase inhibitory protein (RKIP) by EtOH plays a critical role in sensitizing the pancreas to secretagoge-induced inflammation; and that biphasic regulation of RKIP expression is critical for functional tissue repair following injury.
Aim 1: To define the function of RKIP in EtOH-induced GPCR sensitization
Aim 2: To define the molecular and cellular mechanisms regulating RKIP expression.
Aim 3: To define the role of RKIP in exocrine pancreas injury repair.
Working hypothesis: EtOH sensitizes acinar cells to physiologic regulators of zymogen secretion (i.e., CCK, BBS and Ach) by inhibiting the normal mechanisms of GPCR desensitization.
Working hypothesis: RKIP expression is primarily determined by its rate of protein degradation. During pancreatitis, RKIP expression is suppressed by activation of the transcriptional repressor SNAIL.
Working hypothesis: Repression of RKIP is essential for induction of acinar-to-ductal cell metaplasia required for injury repair; reexpression of RKIP is necessary to store homeostatic exocrine function.
Approach:
1)Define the mechanisms of GPCR desensitization in pancreatic acinar and stellate cells
2)Define the function of RKIP in EtOH-induced GPCR sensitization
3) Define the role of RKIP in secretagoge-induced pancreatitis
Approach:
1) Define the kinetics of RKIP protein synthesis and degradation
2) Determine the roles of phosphorylation and ubiquitination in regulating RKIP expression
3) Define the transcriptional regulation (repression by SNAIL) of RKIP
Approach:
1) Assess the effects of RKIP knockdown (KO) on time-course and severity of CR-induced pancreatitis
2) Determine effects on RKIP KO on the sensitivity to recurrent pancreatitis and time course for development of chronic pancreatitis
Expected outcomes: Precise knowledge of the functions of RKIP, GRKs and PKCs in EtOH-induced GPCR sensitization and secretagoge-induced pancreatitis
Expected outcomes: Precise knowledge of the pre- and posttranslation mechanisms controlling RKIP expression in pancreatic acinar and stellate cells
Expected outcomes: Understanding of the role of RKIP expression on the functional recovery of pancreas tissue following secretagoge-induce inflammation
Positive Impact: Once we know how RKIP activity and expression contribute to the induction and resolution of pancreatitis, pharmacological manipulations of either RKIP, its upstream regulators or downstream effectors will provide new and innovative approaches to treat and/or prevent recurrent inflammation in high risk patients.

Appendix E

developed for most classes

Planning Doc Jan 12 2012, epicardium and myocardial injury response

Science content competencies:

1. Demonstrate understanding of gross and microscopic structure of the heart. Integrate this knowledge with experimental scenario
2. Describe healing response after myocardial infarct
3. Reason out experimental design of cre-lox experiment for lineage tracing
4. Apply knowledge of hormone receptors, recombination to the lineage tracing experiment.
5. Relate the concept of epithelial mesenchymal transition to wound healing/repair
6. Discover, through data analysis from paper, the concept of "subepicardial niche"
7. Describe clinical implications of reported results.
8. Critique experimental approach and claims of clinical utility.

Non content competencies addressed/objectives:

1. Team work: recognize and value contributions of others, provide input on group work, identify and perform role in team, reflect on team function and input of members, peer assess contributions (B professionalism and C communication) Management (E)?
2. Scientific reasoning: evaluate graphically displayed data (D3), anticipate next question in logical approaches to biological question (D4), determine appropriateness of methodology used to approach research question (D4)
3. Life long learning: Identify gaps in personal knowledge base and create specific plan to address this. (B2)
4. Teaching: Share knowledge in the group, explain concepts to others. (As communication and as professionalism)

Appendix E

A. For knowledge and understanding:

Learning goal	Assessment	Activity	Explanation of alignment of 3 prior
Content 1,2,4,6,7,8	POGIL rubric, observation of group work	POGIL activity	
Content3,4,5	Graded quiz	Pre-class reading, POGIL	

Appendix E

B. For skills and/or applications

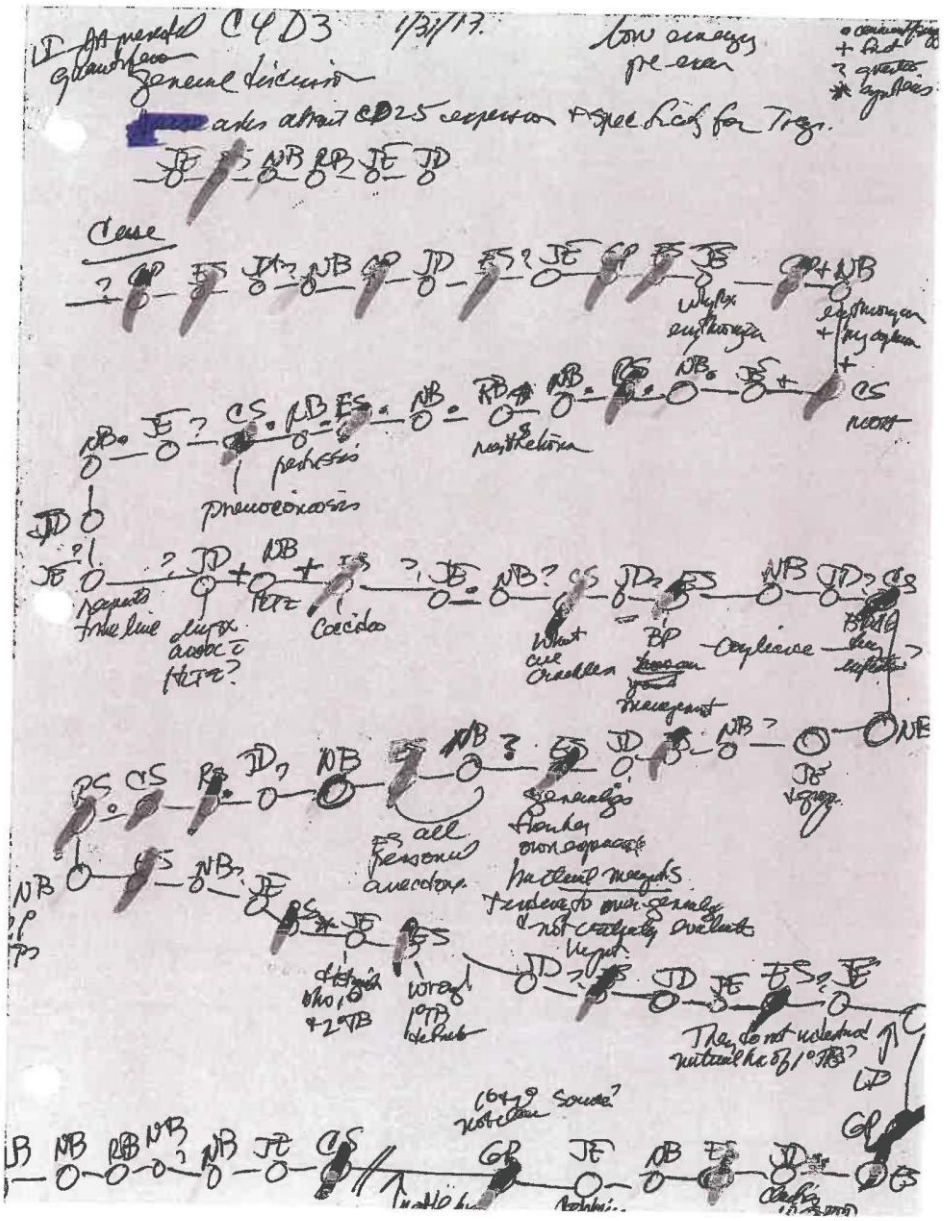
Learning goal	Assessment	Activity	Explanation of alignment
Evaluate and interpret experimental data	Group work, written paper and discussion (need rubric?)	POGIL exercise	
anticipate next question in logical approaches to biological question (D4)	Group work, written paper and discussion	POGIL exercise	
recognize and value contributions of others, provide input in group work,	Modification of peer assessment rubric, done by faculty instructors	POGIL exercise	
Articulate and perform role in team,	By faculty and group according to rubric	POGIL exercise	

Appendix E

C. For attitudes, synthesis, evaluation, analysis, or performance

Learning Goal	Assessment	Activity	Explanation of alignment
reflect on team function and input of members, peer assess contributions (B professionalism and C communication) Management (E)?			
Discover generalizable concept through Concept discovery:	Written POGIL exercise	POGIL	
Link knowledge obtained with previous topics; develop concept map and link with prior	Evaluation of concept map by experts ,)	Concept map exercise, continuation of week 7 exercise	
Create plan to address gaps in knowledge base; teach others in group about what was learned	Standard rubrics, TBD	Oral presentation "mini-lecture" to be scheduled for first Jan session	
Content 7,8	POGIL rubric, observed discussion	POGIL	

Appendix F



Appendix G

Syllabus

management , F) teaching , and G) external services. In this course, Practice of Translational Sciences I, students will explore and apply basic concepts associated with each of the domains.

The course will meet for two , two hour sessions weekly. In general, one class meeting per week will be devoted to science content competencies (A), building on topics explored in the parallel GAR course. Scientific content will be organized around core principles of physiology and core topics in human pathology(see guiding principles and competencies attachment). The other class meeting in the week will be devoted to building knowledge and skills in the other, non-content competencies (B-G).

Teaching methodology will be based entirely on active learning modalities, such as Process Oriented Guided Inquiry Learning, a "student-centered instructional approach that simultaneously develops discipline content mastery and key process skills such as critical thinking, effective communication, and teamwork" (www.pogil.org). In each POGIL session, students will work in a small group in which each group member has a defined role. To ensure adequate preparation, pre-class assignments will be given and many class sessions will begin with a short graded quiz covering the preparatory material. In class, students will work through specifically designed guided inquiry materials that will lead them through the steps of interpreting information, formulating their own valid conclusions, and applying what they have learned to reinforce the developed concept.

Course Schedule:

The biomedical science topics listed in the table below are linked to PBL cases in the GAR course that will be taken simultaneously

Week	Session	Topic	Competency(ies)
1	1	Pedagogy of the HPTM curriculum; how adults learn; introduction to POGIL and the curricular map	A2a F1a
1	2	Mechanics of respiratory physiology	A2a, C1a
2	1	Tools for translational science knowledge; membership in our society; learn to do PubMed search, sign up for table of contents for journals of interest	D1a, D2a, G3a
2	2	General concepts of vascular system physiology	A2a
3	1	Definition of translational research	B1a
3	2	Tissue response to injury--introduction	A3a
4	1	Philosophy of science	D1a
4	2	General concepts of pharmacology; neuro-pharmacology of pain	A1a, A1b, A2a
5	1	Societal perception and expectations of science	B1a
5	2	Endocrine physiology and homeostasis	A2a

Appendix G

Syllabus

6	1	How science functions in the US; funding etc	B1a
6	2	Chemoreceptors and baroreceptors in the vascular system	A2a
7	1	Tools for organization and learning	D1a
7	2	Physiology of the lymphoid system; types of leukocytes and their functions	A2a
8	1	Introduction to systems biology. Basic concepts of statistics	E1a, D2a, D4a
8	2	**EXAM**	

Grades:

Student assessment will be multi-modal and linked to defined competencies. Throughout the curriculum, and beginning with this course, students will use a learning portfolio to demonstrate achievement of individual competencies. A commercial electronic portfolio product will be used (eFolioworld.com), as has been adopted by the SON at UTMB.

The overall components of student grades are listed below.

- Content evaluation (exams): 40%
  - Quizzes (~~readiness assurance test~~) (in aggregate): 10%
  - Post-exercise quizzes in aggregate: 10%
  - Written exam (final, in class-essay style): 20%
- Competency assessment: 60% (Detailed grading rubrics for each component will be made available to students during the course.)
  - Reflective writing 10%
  - Peer assessment (after appropriate training, students will use this method to help build their team-work skill).10%
  - Group problem solving (POGIL exercises) 20%
  - Oral presentations 10%
  - Learning portfolio 10%

Final course grades will be determined using the GSBS grading scale:

90-100%: (Includes satisfactory performance in all elements defined above)=A
80-89% =B
70-79%=C
69% or below=F

Appendix H

PTSC 2 FINAL EXAM NAME:

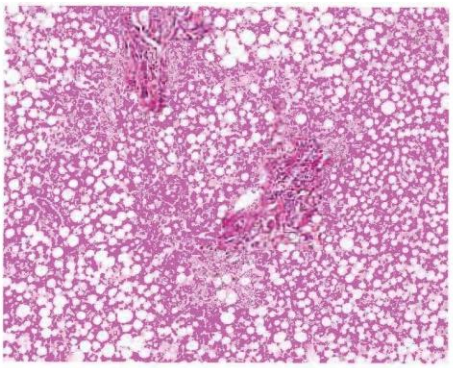
In-Class Examination

Instructions:

This exam has 5 questions. You must answer 4 out of the 5 questions. You are required to answer questions #1, 2, and 4. You can choose either #3 or #5 as a final question. You have the entire class time to work. You may write on the test materials; final answers should be legible and clearly written for grading. You may record final answers on notebook paper, if you need prefer, keeping answers to each question on separate sheets. All materials must be turned in at the end of the exam.

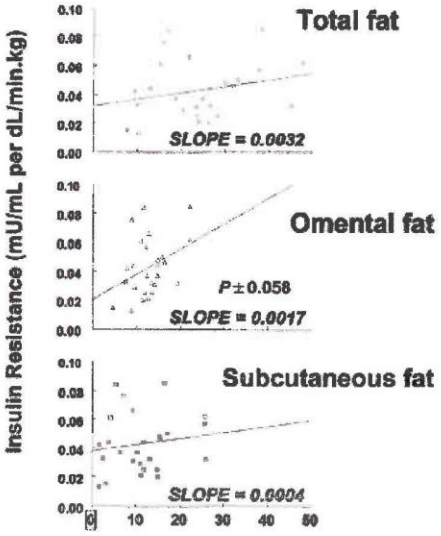
1. Metabolic syndrome is associated with hepatic steatosis (non-alcoholic fatty liver disease or non-alcoholic steatohepatitis) and central obesity. Consider the figures below in answering the following questions:
    a. Describe the normal effects of insulin on signaling pathways in hepatocytes and liver cell functions.
    b. Describe the abnormalities of insulin signaling and liver cell functions in insulin resistance/metabolic syndrome. (Your answer should include some discussion of the histopathology seen in Figure 1).

Figure 1



c. Figure 2 shows data from an experiment in dogs in which insulin resistance was measured (y axes) and correlated with the amount of fat in various body locations, measured by MRI imaging studies (x axes). Articulate a research question to probe a potential mechanism of the observed association between omental fat quantity and insulin resistance.

Figure 2



Appendix H

2. You've just been recognized for your discovery that over-expression of the alpha2-aderengeric receptor is a risk factor for type-two diabetes. As a result of your prominence in the field, you have been invited to a major pharmaceutical company for a brainstorming session. The working group that you are leading is tasked with developing ideas for novel molecular approaches to increasing glucose up-take by insulin-resistant cells. With your expansive knowledge of the normal molecular mechanisms by which insulin stimulates glucose up-take by cells, briefly outline two potential molecular targets and therapeutic approaches that your group would use to enhance the insulin-sensitivity of cells in patients with type-2 diabetes.

3. TGF-b is a multifunctional cytokine that regulates a plethora of cellular responses including tissue homeostasis and proliferation. In relation to cancer, TGF-b can either be a tumor suppressor or act to promote invasion and metastasis. Specifically in breast cancer, TGF-b signaling can drive metastasis as well as promote a favorable niche in the bone microenvironment.

   Describe a cellular or molecular mechanism in regard to TGF-b signaling that can:

   a) enhance invasion from the primary tumor microenvironment and

   b) promote the growth metastatic breast cancer cells within the bone microenvironment.

4. During class, we studied some of the data from the following article:

A model for personalized in vivo analysis of human immune responsiveness. Kalscheuer H, Danzl N, Onoe T, Faust T, Winchester R, Goland R, Greenberg E, Spitzer TR, Savage DG, Tahara H, Choi G, Yang YG, Sykes M. Sci Transl Med. 2012 Mar 14;4(125):125ra30. PMID: 22422991.

The authors of this paper discuss the following:

Immunodeficient mice receiving human fetal thymus grafts and fetal CD34+ cells intravenously produce robust human immune systems, allowing analysis of human T cell development and function. However, this model is limited to the analysis of fetal HSC-derived immune systems.

The study of the immune system of patients who already have the disease of interest cannot distinguish underlying causes from effects of disease evolution, disease treatment, or precipitating environmental factors. An ideal situation would be to be able to "reset" the immune system of the individual to a state similar to that before the beginning of the disease, and this could be done through the use of humanized mice.

To use humanized mice to study the immune system of humans, particularly T cells, who already have a condition in which the immune system plays a role, immune systems must be generated from adult hematopoietic cells. Indeed, the group of Dr. Sykes developed a "personalized immune" mouse as a new model for individualized analysis of human immune responses by reconstituting mice with hematopoietic stem cells (HSCs) aspirated from bone marrow of adults with the condition of interest and cryopreserved fetal thymic tissue that was HLA-matched to the adult bone marrow.

Now, on the topic of cancer, a recurring theme of POTS 2, immunoevasion has been described as an emerging hallmark of cancer, whose generality as a core hallmark capability remains to be firmly established. Experimental evidence suggests that highly immunogenic cancer cell clones are routinely eliminated in immunocompetent hosts—a process that has been referred to as "immunoediting"—leaving behind only weakly immunogenic variants to grow and generate solid tumors. It is also known that the tumor microenvironment can induce tolerance against tumor antigens.

a) How would you use the personalized immune mouse to study immunoevasion?

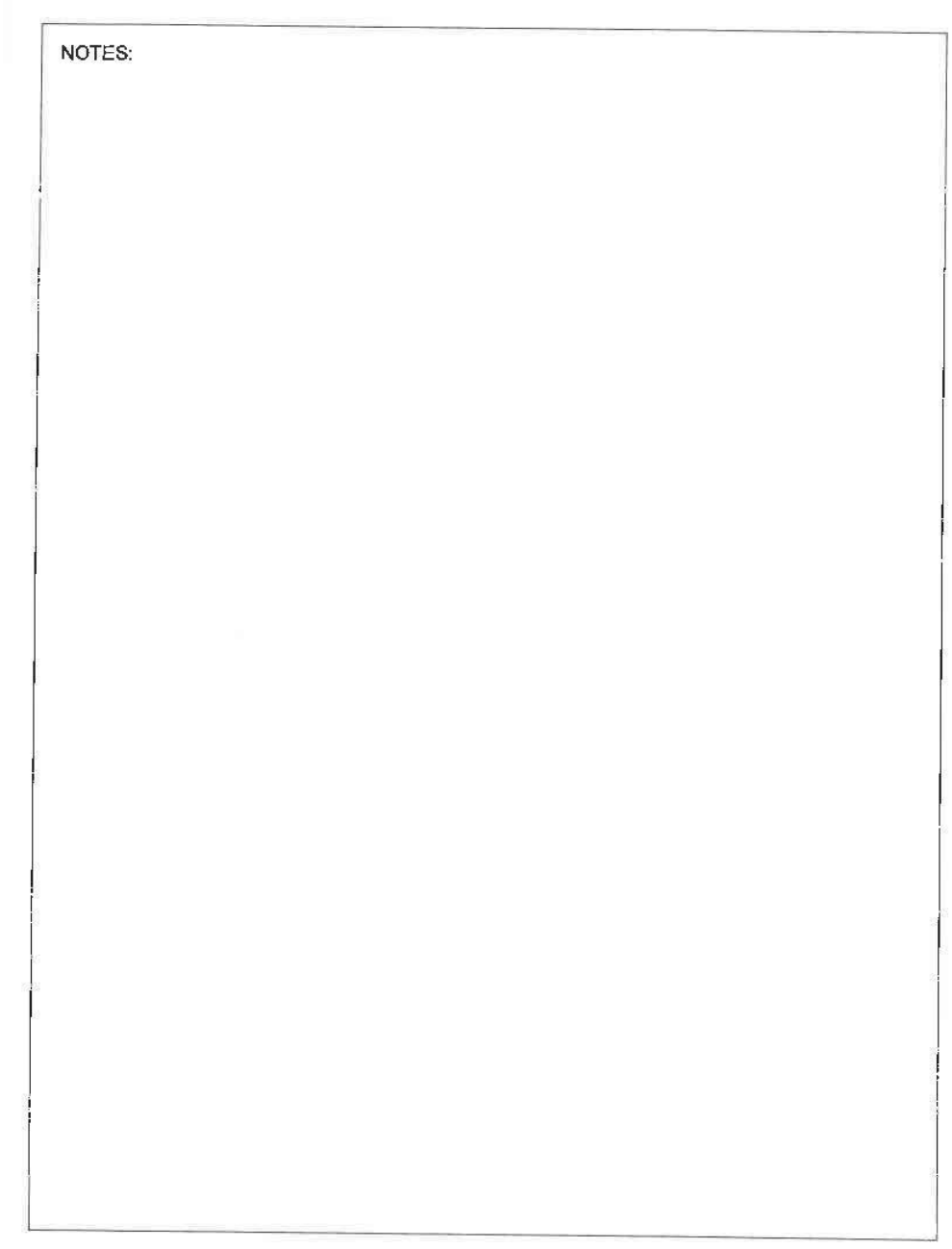
b) What kind of experiments would you do? Under what framework question or hypothesis?

Appendix H

5. a) Describe two ways in which cancer cells evade apoptosis.

b) Design a method of reactivating apoptosis in one of the above.

Appendix H



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