INTEGRATION OF PATHOLOGY TEACHING: STUDENTS AND FACULTY PERCEPTIONS

A Thesis Submitted to the College of Graduate Studies and Research in Partial Fulfillment of the Requirements for the Degree of Master of Medical Education in the Department of Educational Administration at the University of Saskatchewan, Saskatoon, Saskatchewan

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Abstract

Reports on undergraduate medical education in the recent decade clearly point towards a need for greater integration of content in the medical curriculum. The pedagogy of an integrated curriculum embraces many models of integration, representing a continuum where full integration sits at one end and discipline–based teaching at the other, with many intermediate steps between the two extremes. A vertically integrated curriculum seeks to bridge the preclinical and clinical divide in content by teaching the content concurrently rather than sequentially, but still retaining discipline boundaries. A horizontally integrated curriculum seeks to further break down the distinctions between the basic and clinical sciences, with the early years of the program focusing on the basic sciences and introducing clinical features into the program wherever possible as part of a gradual shift to a more continued collaborative clinical focus.

At the College of Medicine, University of Saskatchewan, the overall redesigned curricular program will be phased in over the next four years of the curriculum, with a greater emphasis towards an integrated approach of the teaching and learning of human disease. In the first year, this has led to the creation of a patchwork quilt teaching style, where a cross disciplinary functional system incorporates elements of the traditional basic science components of anatomy, physiology, embryology, and histology, and an introduction of core general pathological concepts in a vertical and horizontal integrated fashion.

The main objective of this research, detailed in Chapter 1, was to investigate the advantages and disadvantages of the two models of horizontal and vertical integration of the reorganized structural teaching of pathology through an analysis of the perceptions of medical educators and first- and second-year students in the undergraduate curriculum at the College of Medicine, and based contextually within a theoretical framework of the newly designed medical curriculum.

In this context, the literature review in Chapter 2 focused on four major areas that are the underpinnings of the pedagogy of pathology teaching in the undergraduate medical curriculum: (a) integration concepts in relation to medical education; (b) the practice of pathology teaching in the past, present, and future; (c) theories of curricular

integration; and (d) its effects on the student learning environment. This resulted in the development of the pre-research conceptual framework for this study.

The in-service monitoring research design for this study included a triangulation of research methodologies using multiple data sources, multiple subjects, and multiple data collection techniques using comparative qualitative and quantitative research inquiry techniques. Data collected from the semi-structured interviews of the medical faculty provided not only an understanding of the educators' perceptions towards the integrated curriculum, but also some insight towards their feelings of respect, power, and identity in this new integrative environment. Personal perceptions of fear, apathy, and stress and perceptions regarding accountability and sustainability of this integrative process were also observed as arising from this educational intervention.

Quantitative data analysis collected from the first-year student survey questionnaires derived the following grand mean responses with respect to the vertical integration of pathology teachings: student learning satisfaction with integration (3.6); the learning environment (3.8); student engagement (3.3); and student stress (2.9). The grand mean responses to horizontal integration showed a similar trend: student learning satisfaction (3.7); learning environment (4); student engagement (3.5); and student stress (3). Perceptions of the second-year medical students to horizontal integration of pathology teachings were comparable: student learning satisfaction (3.7); learning environment (4.2); student engagement (3.7); and student stress (3.1). A comparison of first- and second-year medical students showed a significant difference ($p<0.05$) with respect to the domains of student engagement with active independent learning. This difference may, perhaps, be directly related to the level of maturity of the first- versus second-year students, coupled with the receptiveness, awareness, and familiarity of the integration process between the two groups. There were no perceived differences between the horizontal and vertical integrative learning environments. Likewise, inter-modular and inter-system components within the vertical and horizontal integration did not demonstrate any major differences. These results are explored in greater detail in Chapters 4 and 5.

One of the noteworthy findings of this study was the statistically significant difference between the perceptions of first-year medical and dental students' in both vertical and horizontal integrative environments in many domains, including student learning satisfaction ($p<0.001$); learning environment ($p<0.001$); and student engagement ($p<0.01$). There was no difference in student stress perceptions between the two groups of first-year students. The main theme linking these disparities seemed to be related to a lack of academic and vocational relevance of the undergraduate medical course teachings to the inter-professional composite cohort of dental students. This has led to the creation of an independent course dedicated to first-year dental students. This rapid in-service responsive evaluation thus recognized a major immediate dissatisfaction, resulting in curricular program change. Other curricular changes are underway to address student concerns of ineffective curricular content and time management. An unexpected emergent theme of this study was the recognition of a "perception gap" between students and faculty medical educators. This is probably nested in complex factors, such as generational learning differences and attitudes towards the learning environment, which are beyond the research scope of this study.

In conclusion, the results of this study strongly supports an overall balanced composite curricular design, including facets of horizontal, vertical, and diagonal integration that meet the needs of the student learner and satisfy the expectations of the medical faculty as the best practice plan for the instruction of pathology in the newly designed integrated medical curriculum. As learning is the central function of all education, perhaps the future of successful effective medical educational learning environments are those in which an intergenerational component of students and instructors can engage as true joint partners in curriculum organization to provide the right balance between faculty expectations and student learner needs.

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Closer to home, thanks to my family for believing in me, and despite glitches allowing me to explore this quest of mine. And finally to my teenage lads Vinay and Gowtham, this thesis is dedicated to both of you from Mom who did this when she is fifty and encourages each of you to dream the impossible and achieve the possible. Thanks for your quiet appreciation and words of encouragement, as I struggled through some long hours on many nights. Thanks for never questioning the time and effort that I invested in this work, in this personal odyssey of mine. I am indebted to you both as my life runs through you, nourishing, strengthening and providing purpose in my life. In no small part was this work possible without both of you. For this and all you are, always, - thank you.

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Chapter 1

Introduction to the Problem

Medical educators in the twenty-first century readily acknowledge the impacts of ever increasing "new" scientific information (i.e., content overload) and an intense technologically driven world on student learning and the quality of their learning experience (AAMC, 1984; Anderson & Swanson, 1993; Cooke, Irby, Sullivan, & Ludmerer, 2006). This has led medical educators to search for a more effective design for delivering core material to medical students. The new pedagogical shifts in undergraduate medical education have resulted in major revisions in curriculum program design and delivery (GMC, 1993; Harden, Susette & Dunn, 1984). In this era of social accountability, there is increased awareness and recognition to deliver a suitable education that will prepare the medical student for practices focused on patient outcomes.

Medical education programs leading to the M.D. degree in the U.S. and Canada must achieve and maintain accreditation by the Liaison Committee on Medical Education (LCME). Demands to comply with many of the accreditation standards have resulted in major curricular revisions at the College of Medicine in the University of Saskatchewan. The pedagogy of an integrated curriculum embraces many models of integration that represent a continuum, with full integration at one end and discipline–based teaching at the other, and many intermediate steps between the two extremes. A vertically integrated curriculum seeks to bridge the preclinical and clinical divide by teaching content concurrently rather than sequentially, while retaining discipline boundaries. A horizontally integrated curriculum, however, seeks to further break down distinctions between the basic and clinical sciences, focusing on the basic sciences in the early years and adding clinical features into the program wherever possible, gradually shifting to a more clinical focus but maintaining continued collaboration.

At the College of Medicine, the overall redesigned curricular program will be phased in over the next four years of the curriculum, with a greater emphasis towards an integrated approach of the teaching and learning of human disease. The proposed revisions of the curriculum continue to be on a system-based functional approach, rather than disease- or organ-based curricula. In the first year, this has led to the creation of a cross-disciplinary functional system teaching style that incorporates elements of traditional basic science components including anatomy, physiology, embryology, and

histology. For the pathology teachings, this has resulted in the construction of a patchwork quilt of some core general pathology concepts within the integrated foundational course in a vertically integrated model, and a stand-alone temporally aligned horizontally integrated core pathology course in the first-year curriculum.

In this context, it is hoped that the comprehension of the core basic pathological concepts that underlie systemic diseases in the first-year (career-onset) will promote an appreciation and an enhanced understanding of the value of pathology and laboratory medicine in the rationalization of clinical diagnosis, therapy, and management of diseases as applicable to the real life practices of medicine and dentistry. In this context, the role of the laboratory in the day-to-day clinical diagnosis and management of patients in relation to systemic and oral pathologies will be explored. Students will continue to acquire information to build their repository of fundamental core knowledge. They will also be able to understand concepts of the basic pathological processes, both in the given framework of vertical integration within functional modular systems, and in a horizontal integration framework of a stand-alone dedicated pathology teaching course. This introduction of the basic general pathology in the first year of the medical curriculum has facilitated the horizontal temporal integration of systemic pathology teaching to the currently established systems-based model of the teaching of human disease in the second- and third-year's curriculum. This teaching of systemic pathology will continue to explore the pathological changes of important disease processes in each system module through the study of pathogenetic mechanisms of diseases, with emphasis on their clinical pathological correlation. This teaching will be conducted in a horizontally integrated fashion for the remainder of the systems.

THE IMPORTANCE OF PATHOLOGY TEACHING IN THE UNDERGRADUATE MEDICAL CURRICULUM

The disciplines of pathology and laboratory medicine help interweave the threads of understanding complex concepts of human health and diseases that connect otherwise artificially separated disciplines, organs, and systems. An understanding of pathogenetic mechanisms and the pathological basis of disease is integral to the recognition, awareness, diagnosis, and optimum, timely clinical management of a patient/client in the clinical disease processes. Facilitation of such integrated thinking helps to inculcate a scientific empirical approach to the study of medicine. Interrelationships of diseases, both within and from different systems, are better understood with the

study of appropriate systemic pathology concepts. This may encourage the student to integrate knowledge acquired both from within and between various clinical/organ/discipline systems, and help to view the patient as an integrated sum of the "whole" rather than a compartmentalized merchandise of clinical information. Such a holistic integrated clinical approach will potentially lead to appropriate cost-effective utilization of laboratory services, thereby fulfilling the current priority of outcomes-oriented medical education in this era of budget conscious healthcare systems. Thus, implementation of pathology teaching in the newly integrated medical curriculum needs careful evaluation and monitoring by both faculty (the deliverers) and students (the receivers). Set in their contextual theoretical framework, the advantages and disadvantages of the horizontal and the vertical integration models were explored through the perceptions of students and medical educators participating in these learning environments.

In this framework, the research for this thesis studied three key areas:

1. current contextual medical curriculum reform and design, with special emphasis on the evolving models of an integrated medical curriculum and its relationship to the practices of pathology teaching in medical curricula;
2. students' perceptions of the two models of integrated pathology teaching; and
3. medical educators' perceptions of the two models of integrated pathology teaching.

These three areas were explored in the literature review and were the focus of elaboration in the conceptual framework and research problem for this study.

RATIONALE: THE NEED FOR THIS STUDY

The results of this research will guide the reform, redesign, and renewal of the teaching of pathology within the contextual framework of the newly integrated undergraduate medical curriculum. This is a key element in meeting the accreditation requirements for the College of Medicine at the University of Saskatchewan. This integrated method of pathology teaching may serve as a model to facilitate further integrative curricular design approaches amongst the various fragmented discipline-, organ-, and system-based curricula in the medical undergraduate program.

This information may also be relevant for pathology course directors across medical schools in Canada and North America who face similar challenges adapting to ongoing medical curricular reforms in undergraduate medical education.

THE PURPOSE OF THIS STUDY

The purpose of this study is to enhance pathology instructional pedagogy by investigating the advantages and disadvantages of two models of horizontal and vertical integration of the teaching of pathology. This is accomplished primarily by analyzing the perceptions of individual faculty medical educators and first- and second-year students in the undergraduate curriculum at the College of Medicine in Saskatoon, and contextualizing this analysis within the theoretical framework of the newly designed medical curriculum.

MAIN OBJECTIVES OF THE RESEARCH

The objectives of this research were:

1. To examine students' perceptions (as recipients to the implementation) of this integrated model in terms of:
    a. key domains of students learning satisfaction, student engagement, quality of the learning experience in the new integrative learning environment, and student stress;
    b. comparison of first- and second-year medical students' perceptions; and
    c. comparison of first-year medical and dental students' perceptions.

2. To examine the faculty's perceptions (as the delivery agent of this implementation) to this integrated model in terms of:
    a. level of instructors' awareness of the varied concepts of an integrated curriculum design and its merits and demerits;
    b. instructors' satisfaction with and awareness of their teaching environment; and
    c. instructors' assessment of the teaching and learning experience.

3. To compare these perceptions within and between the vertical and the horizontal integration model by examining:
    a. inter-modular comparisons amongst first-year medical and dental students;

b. intersystem comparisons amongst second-year medical students; and

c. the vertically integrated component versus the horizontally integrated component amongst students and educators.

THE RESEARCH FOCUS

The guiding research question was: What are the advantages and disadvantages of the two models of horizontal and vertical integration of teaching pathology according to (a) the existing theoretical framework of curricular integration, and (b) the perceptions of students and medical educators who participated in the undergraduate medical curriculum for the academic year August 2006-May 2007?

This question is fundamental to the development of the best curricular design for teaching pathology in an undergraduate medical curriculum. Insight for this blueprint involved feedback from both the student body and the faculty pool of medical educators. The research was conducted by pursuing three specific research questions:

Research Question #1. What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum within a theoretical framework of the existing literature?

Research Question #2. What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum through the lens of the student participants with respect to their learning satisfaction, engagement, learning environment, and stress?

Research Question #3. What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum through the lens of faculty-medical educators as key participants in this study?

SIGNIFICANCE OF THIS STUDY

In the current climate of rapid and ever changing attitudes and beliefs in the delivery of quality healthcare, medical educators need to rise to the challenge by redesigning the medical curriculum to answer these needs. To the best of my knowledge, this is the first academic exploration of the implementation of an integrated pathology teaching practice in the field of undergraduate medical education. The study is: (a) timely, as the new integrated curriculum is being

implemented in August 2007; (b) valuable, as it will be useful towards assessing accreditation processes; (c) 'new', as this is a study of a new integrated curriculum; and (d) appropriate, as it provides a rapid evaluation of a new educational intervention. This study will aid in the understanding and increased awareness of the emerging concepts of integration in the medical curriculum. The results of this study will provide an in-service monitoring form of evaluation of the newly implemented curriculum, and highlight strengths and weaknesses, including any major immediate errors or dissatisfactions. The findings in this study will provide additional useful information to the College of Medicine in its continued ongoing process of curricular renewal and redesign. Recognition and understanding of such curricular integration designs may help develop a dedicated group of "integration specialists" who can be actively involved in curricular reform, creation, planning, mapping, and overall design of such a curriculum. In the long term, the data collected will also enhance development of a best practice integration plan for the most effective structural organization of the teaching of pathology in the undergraduate medical curriculum.

Knowledge obtained from this study regarding integrated approaches to the teaching of pathology will be utilized in the curricular design of the new course (Path 805.3) in the newly created Masters of Science program at the School of Physical Therapy at the University of Saskatchewan, to be implemented in January 2008.

PARAMETERS OF THE STUDY

The elements of this study, including assumptions, delimitations, limitations, and definition of terms, are set forth in the following section.

Assumptions

The following factors are assumed in this study:

1. This study assumes that curricular redesign of integrated pathology teaching will ultimately improve student learning and enhance students' quality of learning experience through improved integrated learning environments.
2. This study values both the students and the medical educators as useful independent but related lenses for reflection and analysis of educational activities.
3. There are numerous components to this learning environment not addressed in this study, including change, evaluation, and assessment of immediate or long-term learning.

4. The study assumes that instructors are instrumental in the effective adoption and implementation of the revised integrated curriculum, and, as such, will be able to recognize various challenges (positive and negative) in its implementation.

Delimitations

The following factors contribute towards establishing the study's boundaries:

1. This study is delimited to voluntary participation of student and teacher perceptions from a single medical school. As such, theirs may not be representative voices for all students and teachers.
2. Although preliminary preparation of integrated pathology teaching and follow-up evaluation extends over the four years of the curriculum, the study data collection is limited to a period of five months (January-May 2007).
3. The data collection focuses on the experiences and perceptions of adult participants as expressed in their written and verbal communications through recall of classroom events that generate reflection and discussion.
4. The theoretical framework and background of this research was not explained nor shared explicitly in its entirety to all the participants.
5. The theoretical framework of this research was situated in the applied field of medical educational administration rather than in areas such as educational psychology, sociology, or philosophy. Therefore, literature utilized from these domains was selective and confined to areas with relevance, apparent use, and applicability in medical education practice.

Limitations

The following factors are potential shortcomings for this study:

1. The quality of the data might have been affected by the students and faculty medical educators' degree of interest, active participation, and quality of interactions and relationships. Further limitations might have been posed by the participants' ability to understand and articulate their own understanding and learning of the concept of integration in medical curriculum.

2. The study was limited by time factors: (a) limited period for data collection, and (b) the available time and energy of the students and faculty.
3. Participation may have been limited because no special funding was sought or obtained for the promotion of student and medical faculty co-operation.
4. Generalization of findings may be inferred by readers to the extent that they see similarities between this situation and their own.
5. The results of this study may be limited by the use of multiple research methodologies. However, it is also possible that this may emerge as a study strength because the results obtained from one method might have been confirmed by data collected independently using another method.
6. As the results were based on data collected on the perceptions of human subjects, these might have been suggestive rather than purely definitive and prescriptive.
7. Finally, this study has only a single author, and so the interpretations and evaluation of the information collected are limited by the author's perceptions and personal biases on observations, personal interests, values, orientations, and interpersonal relationships.

Definition of Terms

"A definition is the enclosing a wilderness of idea within a wall of words."

~ Samuel Butler, retrieved from http://www.quotegarden.com/language.html

Medical curricular design often brings with it a language unique to its application and understanding. The following terms are defined here as they are used in this study.

Perceptions refers to ideas, thoughts, and feelings drawn from an individual's point of view and is drawn from personal experiences, knowledge, skills, and prior learning.

An **integrated medical curriculum** refers to the medical curriculum that has greater content integration of the various subjects, disciplines, and systems. This integrated curriculum aims to move students beyond mere fact and concept acquisition to a level of scientific fluency by using the common language of medical science so that they can think creatively about medical solutions.

Horizontal integration is the integration of the medical school curriculum over a single year across courses and disciplines by identifying concepts or skills, particularly those that are clinically

relevant and cut across the curriculum, and use these as an integrated focus for presentations with clinical examples and in course materials.

Vertical integration is the integration of the medical school curriculum across all four years by interweaving clinical skills and knowledge into the basic science years. This reinforces and continues to teach basic science concepts as they apply during the clinical years.

Curriculum reform is the change or redesign of the four-year medical curriculum from its existing state of design.

Systems-based curriculum is the study of medical science designed and based on the systems of the body, such as the cardiovascular or respiratory system.

Organ-based curriculum is the study of medical science designed and based on the organs of the body, such as the heart or lungs.

Disease-based curriculum is the study of medical science designed and based on the diseases that affect human beings, such as diabetes, asthma, or hypertension.

Functional modular system is the study design for medical studies centered on functional modules such as the defense, nutritional, or communication modules.

Intermodular comparisons are comparisons between these modules.

Intersystem comparisons are comparisons between these systems.

Pathogenetic mechanisms are the basic processes that underlie the causation and effects on the target organs that represent the disease state.

Pedagogy is the art or science of teaching, including the principles and methods of instruction.

ORGANIZATION OF THIS THESIS

Chapter 1 of this thesis provides the background to the nature of this study, as well as a description of some of the language used in medical education and its applications.

Chapter 2 consists of a review of the literature regarding the concepts and models of integration in medical education in the context of changes in the medical curriculum over the past twenty-five years. The practice of pathology teaching in the past, present, and the proposed future,

with an examination of students' experience in their learning environment, is explored to complete this study's pre-research contextual framework.

Chapter 3 provides a detailed discussion of the design strategies used to answer the research questions. This study's design employs a triangulation of research methodology including multiple data sources, multiple subjects, and a multiplicity of data collection techniques using comparative qualitative and quantitative research inquiry methods.

Chapter 4 provides an analysis of the collected data and observations of the perceptions of students and faculty medical educators in relation to the research questions.

Chapter 5 provides a summary with conclusions and suggested implications of this study with the evolution of the post research contextual framework. Unexpected findings and their discussion provide another dimension for answering the original research question, along with suggested implications and recommendations for further study.

CHAPTER 2

Literature Review

INTRODUCTION

The current landscape of medical education in North America is changing, from being predominantly disease-centered to being patient-centered, in response to the ongoing structural reorganization of health care delivery. Furthermore, an integrated health care team is the new strategy for countering the ever increasing demand of physician care outside the hospital setting (Jamshidi & Cook, 2003).

Medical education in the mid-nineteenth century was fairly simple, consisting of seven to eight hours of didactic instruction in a curriculum of seven courses and with no stringent entrance requirements. Medical educators in the twenty-first century readily acknowledge the impacts of ever increasing "new" scientific information (i.e., content overload) and an intense technologically-driven world on student learning and the quality of their learning experience (AAMC report1984; Anderson & Swanson, 1993; Cooke, Irby, Sullivan & Ludmerer, 2006).This has resulted in pedagogical shifts in undergraduate medical education that have led to major revisions in curriculum program design and delivery (GMC, 1993; Harden, Susette & Dunn, 1984). The daunting task remains as to "what can be done to bring the knowledge, skills, and values that must be imparted by medical education into better balance and to prepare outstanding physicians for the 21st century?(Cooke, Irby, Sullivan, & Ludmerer, 2006)."

Integration in the field of medical education is a relatively new concept. It has been and continues to be used in varying contexts spanning the entire continuum of medical education, from a student's entrance, through the undergraduate and postgraduate levels, and continuing as part of the lifelong learning of physicians practicing in their communities. This provides an integrated role in the world communities dedicated to providing healthcare delivery, both locally and globally. The first section of this literature review thus explores the broad notions of integration with special reference to the five "W's"—the what, where, when, who and why of integration in medical education.

The current study is devoted primarily to studying the structural reorganization of the teaching of pathology in the undergraduate medical curriculum. The second section in this literature review is devoted exclusively to existing practices concerning the teaching of pathology in the

undergraduate medical curriculum in the past, present, and foreseeable future.

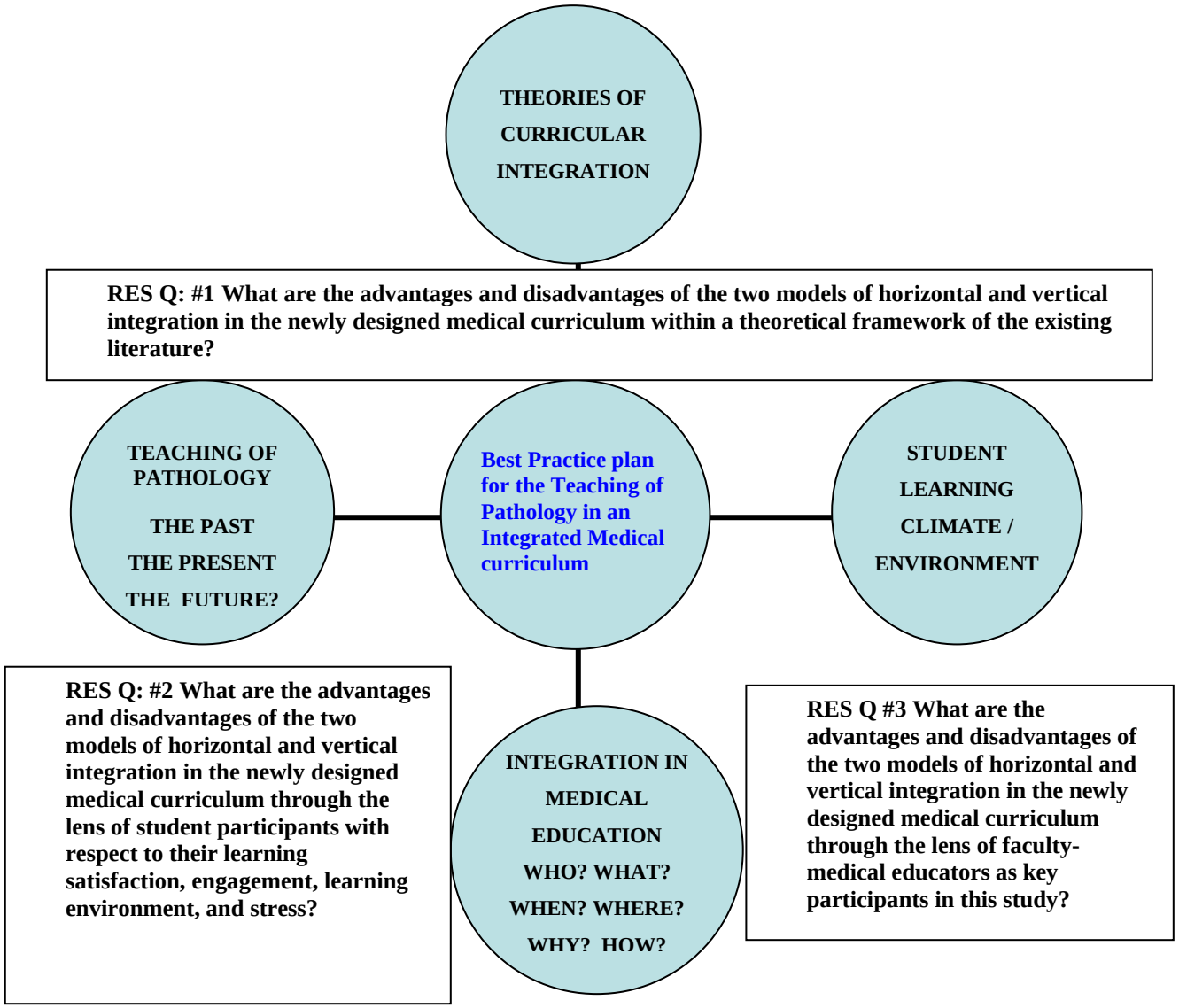

Figure 2.1. Conceptual framework of the literature review

The third section of this review covers theories of curricular integration, with special reference to the teaching of pathology in the undergraduate medical curriculum. The theories of curricular integration, including horizontal and vertical integration, are discussed, seeking an exploration of the evolving concept of "diagonal integration," a different though related form of integration. As all these curricular reforms have an impact on the students' learning environment

and their ability to perform well on standardized examinations, the last section of this literature review is devoted to understanding the student learning climate including the facilitation of conceptual problem solving skills for long term learning and increased creation of the students' self-knowledge bank.

Understanding these four major pillars—(a) the role of concepts and understandings of integration in medicine, (b) the theories of curricular integration, (c) the beliefs of effective pathology teaching practices, and (d) the learning environment—will serve as the underpinnings for the analyses of this study's data.

The diagrammatic representation (Figure 2.1) helps to understand how the research questions evolved from the literature and its relationship to the current study. This figure depicts the research problem in a visual manner relating the interrelationships of: (a) the role of the concepts and understandings of integration in medicine, (b) the theories of curricular integration, (c) the beliefs of effective pathology teaching practices, and (d) the learning environment shaped by student and teacher perceptions that will perhaps lead to the development of the best practice plan for the curricular instruction of pathology.

Following this review of literature is a section summarizing this review within this study's conceptual framework that outlines the relevance of these four major areas of literature to the research questions.

INTEGRATION

This section begins with an introduction to explain the five "W's" of integration namely the what, why, where, when, who, and how of integration.

What is Integration?

Integration is the noun form of the verb "integrate". Integrate as a verb used with an object is defined as "to bring together or incorporate (parts) into a whole, to unite or combine to produce a whole or a larger unit" (Dictionary.com). Integrate as a verb used without an object is defined as "to become integrated, to meld and become part of the whole" (Dictionary .com).

Integration has different connotations in its usage in different disciplines. In the field of mathematics, integration means "to find the solution to a differential equation or to calculate the integral of a function or equation," while in the field of humanities, it refers to "the behavior of an

individual that is in harmony with the environment," and in the field of psychology integration principally refers to "the organization of the constituent elements of the personality into a coordinated, harmonious whole being." In the field of sociology, integration often deals with the understanding of "integrating racial, religious or ethnic groups into the mainstream culture," while in electronics it refers to "the process of placing more than one integrated circuit on a single chip or combining software or hardware components or both into an overall system." In the sciences, however, such as in biology, integration often refers to "the correlation of structural or behavioral characteristics in two or more interacting organisms in a community or organs in an organism resulting from progressive accommodation by natural selection" (Dictionary.com). The word, obviously, has many varied meanings.

What is Integration in Education?

Integration in educational circles refers predominantly to curricular integration. Other broad themes of integration in education include aspects of social integration, such as kids with special needs or globalization of the curriculum by fostering a syllabus for study abroad. As the current study is based on the curricular integration theme, all further discussion will be focused towards some understanding of the same. An integrated curriculum is "an integrated study is one in which children broadly explore knowledge in various subjects related to certain aspects of their environment" (Humphreys, Post, & Ellis, 1981, p. 11). In this setting, skills and knowledge are developed and applied in more than one area of study, linking humanities, communication arts, natural sciences, mathematics, social studies, music, and art. Shoemaker defines an integrated curriculum as an "education that is organized in such a way that it cuts across subject-matter lines, bringing together various aspects of the curriculum into meaningful association to focus upon broad areas of study. It views learning and teaching in a holistic way and reflects the real world, which is interactive" (Shoemaker, 1989, p. 5).

The concept of integrated curricula is not new, and a review of the meaning and elements of this topic in the 1950's is discussed by Dressel (1958), whose definition goes beyond the linking of subject areas to the creation of new models for understanding the world:

> In the integrative curriculum, the planned learning experiences not only provide the learners with a unified view of commonly held knowledge (by learning the models, systems, and structures of the culture) but also motivate and develop learners' power to perceive new

relationships and thus to create new models, systems, and structures (Dressel,1958, pp. 3-25).

What is Integration in Medical Education?

Integration in the field of medical education has been present since the days of Flexner (1910), who examined and incorporated the integration of teaching and working facilities into the general organization of fundamental laboratories in the medical school, to Sir William Osler's commitment to the integration of medicine and information, and the integration of individual physicians all over the world to serve one common cause (Golden, Bryan, & Golden, 2006).

Integration has been, and continues to be, used in varying contexts. Yet, "integration has been accepted as an important educational strategy in medical education" (Harden, 2000). In the field of medical education, the term integration is used to include the concept of "to renew, to restore, to rebuild, to reconstruct, to forming a whole" (Dictionary.com) with respect to the entire continuum of undergraduate education, postgraduate education, and practicing physicians in their communities, providing healthcare both locally and globally. This represents the holistic view of health as determined by the "interplay of two key factors, one based on medical expertise and the other based on the experience of the patient in the context of his/her illness" (Jamshidi & Cook).

Curricular integration in undergraduate medical education emphasizes designs that encourage processes that break down the isolation of the basic and clinical sciences.

Why Should Integration Occur in Medical Education?

The phenomenon of integration is pervasive in a world today dictated by technological innovation, a global economy, and ongoing struggles for political power. Such trends are widespread in the business world, which has utilized integration models of structure, manpower, and products. The phenomenon has been well researched in many organizational studies from the Harvard Business School (Lawrence & Lorsch, 1986). In the field of education, integration at the elementary school levels has occurred in many levels of social class, gender, culture, race, and ethnicity. For example, the academically challenged or gifted programs have been integrated into the mainstream culture (Brown v. Board , 1954).

The landscape of medical education is changing. Medical education in the mid-nineteenth century was fairly simple, consisting predominantly of seven to eight hours of didactic instruction in

a curriculum of seven courses, and with no stringent entrance requirements. Throughout the nineteenth century, most medical education in North America continued to be delivered through either: (a) an apprenticeship system, with instruction from a local practitioner; (b) a proprietary autonomous school system, where physicians owned the medical college; or (c) a university system, teaching diverse types of medicine, such as osteopathic, homeopathic, and chiropractic medicine (Ludmerer , 2004, Beck, 2004).

An influential 1910 Carnegie Foundation report by Abraham Flexner, a schoolmaster and educational theorist, induced dramatic medical reform, leading to standardization of medical education via the introduction of licensing boards. Flexner's unique contribution was to promote educational reform as a public health measure through the evolving concept of "the physician is a social instrument" (Flexner, 1910). Although these reforms raised the quality of medical education in North America, it also led to the closure of smaller rural medical colleges, which predominantly served disadvantaged communities, as well as the closure of many predominantly African American and women's medical schools. Thus was born the era of professional elitism by the end of the century, with the incorporation of medical schools into universities and the creation of academic health centers.

"Academic health centers" is the term used to describe the medical school and its affiliated teaching hospitals—a huge, sometimes intimidating complex that employs thousands of people engaged in advanced research and patient care. These centers seek to maintain the delicate balance of physicians' responsibilities for patient care with their university duties of education and research. The ongoing competition for funding between clinical patient-care, research, and education threatens the existence of these fragile institutions. Key factors that contribute to the ongoing changing trends include: a) changing patient needs associated with an aging population, a dramatic increase of chronic disease, and a large influx of patients from different cultures; b) financial threats to systems that support education and research; c) marketplace dynamics that encourage increased competitive states; d) evolving roles of information management; e) continued medical innovation; f) increasing globalization with ease of travel; and g) evolving disparities in healthcare outcomes that are directly related to race/ethnicity and socio-economic standards. These factors all occur in the context of high social expectation of medicine in today's world. Together with a rising demand for accountability of the profession, there continues to be an increasing emphasis on care that is patient-centered rather than clinician-centered (Jamshidi & Cook, 2003; Newton & DuBard, 2006).

Continued licensure forces, risk management pressures, market economics, the information revolution, globalization of economies, collapse of ideologies, information intensiveness and technology revolution have resulted in the next big wave of medical education reform. These reforms have focused on the process and outcome of the educational experience, with a paradigm shift in medical education from factual rote memorization to promoting problem solvers, active learners, and critical thinkers. This occurs through curricular changes that alter the delivery of instruction as in a problem based curriculum (Baum & Axtell, 2005). Thus began the era of progressive education in medicine (Baum & Axtell, 2005; Ludmerer, 2004).

Medical educators in the twenty-first century are faced with the challenge of providing the right balance of medical education to prepare the next generation of physicians. The research agenda determining these forces is multi-factorial, including seemingly non-related but complex integrated issues such as the data of money, the data of politics, and the data of power. Thus, integration of medical education is embedded within a global picture of health, economy, politics and power.

When Should Integration Occur in Medical Education?

Integration should occur as a continuum from the undergraduate integration of programs and curricula through to postgraduate programs and developing communities of learning and practice. This includes such varied concepts as integrating basic sciences with their clinical correlates, and delivering a unified education to a combined school of dentists, doctors, kinesiologists, nurses, pharmacists, and chiropractors—a multi-dimensional, multi-professional-based curriculum. Another prominent trend is a shift from a disease-centered curriculum to a patient-centered curriculum.

Changing trends in undergraduate medical education include greater emphasis on ‘the process’ and, more recently, ‘the outcome’ of medical education. The problem-based learning movement is perhaps the most widely known example of these process based trends. This has been widely adopted at the undergraduate level in many leading Canadian schools. The College of Medicine at the University of Saskatchewan has adopted a *CASE*-based curriculum comprising *C*o-operative learning (Kanthan & Mills, 2006), *A*ctive learning (Kanthan & Mills, 2005; Kanthan & Mills, 2006), *S*elf-directed learning, and *E*xperiential learning. The latest trends in medical education predominantly focus on the outcomes of the learning process, as is evident at the postgraduate level, where the CanMEDS roles have been adopted as a mandatory requirement

(Frank, 2005). Another emerging trend is the recent upsurge of inter-professional education (Baum & Axtell, 2005). It therefore appears that medical education is in a transition phase on the way to reaching a full circle of reverting from a state of professional elitism to a state of decentralization.

A continuing challenge remains the daunting task of including too much information (i.e., content overload) in the integration with the new technology-driven tools. The information revolution has changed our social landscape to one of complex interdependent organizations, and making our planet a consumer-driven global marketplace. This proliferation of complex integrated organizations has made almost every human activity a collective one being born and raised in organizations such as schools, universities and hospitals.

The ability to integrate interactive virtual reality worlds that can tolerate fatal errors (in contrast to a real tragedy including the use of interactive video, and internet hyperlinks are all integral to the contemporary classroom and are directly related to the process context of the teaching session. It is important to recognize that such technological aides, if used correctly, can facilitate learning by: (a) clarifying and simplifying events, (b) helping to organize concepts in a visual framework, (c) having built-in mechanisms for feedback, (d) bringing things into context, and 5) facilitating integration of structure and function to provide a holistic view of the relevance of the various disciplines and specialties of medical education. As an example, we adopted and harnessed the use of computer games as a review aid for examinations during pathology teaching (Premkumar & Kanthan, 2006).

Continued changing trends in technology and health include: (a) increasing dependency on advanced medical technology with a machine-human interface; (b) the rapid growth of new informational technologies and the development of clinical informational interfaces; (c) automation of data mining exercises; (d) increasing tele-health usage for education and patient care; and (e) automation of basic business process, with increased downloading of computing and data entry on already overworked and stressed health workers (Jamshidi & Cook, 2003).

Further “content wars” in undergraduate curriculum are fueled by increasing diversity and the complexity of updating content requirements in medical education. The responsibility of physicians to the changing societal needs is a result of many factors, including: a) complex and growing medical ethics; b) the business side of medicine (e.g., matching budgets, taxes, and overspending); c) the globalization of medicine; d) the role of genetics and disease; e) the end of life care; f) data management; g) economic issues; h) the rights and role of the patient; i) acceptance of

varied sexual behaviors and their consequences; j) alternative lifestyles; k) changing norms of professional conduct; l) changing laws; and m) changing training trends in the humanities and social sciences.

As an example, due to increasing globalization, education in international health is currently considered a priority rather than a curricular option, as the recent SARS outbreak in Toronto demonstrated. Therefore, it is not enough for today's physician to just develop "a sound and compassionate understanding of human nature" complemented with a sound "understanding of the patho-physiology of disease and its medical management" (Jamshidi & Cook, 2003). Today's physician needs to have an integrated education that includes: (a) a keen sense of social responsibility, (b) an ability to work within a healthcare team delivery model, and (c) efficiency in data and information management.

Thus, integration in medical education involves changes that must be addressed, from entrance criteria to the complete re-organization of medical education, its content, process, and assessment. These will be measured by the outcomes set in its context throughout the undergraduate, postgraduate, and continuing self-directed medical education of practicing physicians. These will be coupled with inter-professional team member skills to build and deliver health to society.

Where Should Integration Occur in Medical Education?

There are many levels in medical education where integration should occur. In the educational structure, there is a prominent trend of centralizing teaching services and moving all such responsibilities to the central level of the college, with a loss by individual departments of control and administration of educational courses. The educational delivery systems are also undergoing change, emphasizing process and addressing such questions as: How can we deliver education effectively? What should be eliminated from the curriculum to make room for other information that will promote increased efficiency of this delivery system? What is the role of inter-professional education? How are student expectations matching their learning experience? What is the student's learning environment?

Implementing changes to address these questions will result in restructuring and reframing educational organizational management systems. This will alter the power and existing culture of the organization, and will include breaking down existing silos and engaging in turf wars. This is a

daunting task, but one that must be addressed if true continuum integration is a goal.

Who Should Integrate in Medical Education?

No one is exempt in either the structure or process of integration. It is important to achieve an intra-professional integration as we are driven towards inter-professional integration, where blurred boundaries and responsibilities are critical issues that will affect the delivery of effective health care.

How Should We Achieve Integration in Medical Education?

There are many ways to achieve integration in medical education. At the entrance level to medical school, implemented changes include allowing humanities and fine arts students to compete for medical school admissions provided that they have the necessary prerequisites. Furthermore, the traditional forty-five minute panel interviews is replaced by multiple scenario-based mini interviews intended to evaluate interpersonal skills, performance and behavior patterns rather than rely on a single chance encounter (Reiter, & Eva , 2005).

At the undergraduate level, major curricular revisions are underway in the College of Medicine. Numerous strategies are being designed and reconstructed to address questions such as:

1. How can the process of education evolve from the delivery of facts to the acquisition of well-organized knowledge networks with effective growth potential?
2. How can information be delivered more effectively, efficiently, and in a way that standardizes content distribution?
3. How can balance be achieved between traditional and innovative teaching styles through the use of technology?
4. How are student learning styles to be integrated with learning experiences?
5. How can undergraduate medical education become a more active process that provides a more vibrant learning experience?
6. How can concepts and insights of, and rationale for, integration be learned?
7. How can content be best tailored to accommodate current health problems?
8. How do we effectively weave in all aspects of being a good physician, not just content expertise and knowledge?
9. How can essential information be identified and then conveyed as information quantity

continues to grow so rapidly?

It is to be remembered that some of what is taught today is likely to be outdated in ten years. Therefore, the emphasis should be to teach concepts and develop concept maps to build "knowledge banks," where deposits, withdrawals, and reinvestments can occur according to fluctuating market values and growth. Such banks of knowledge would need to maintain a healthy reserve to weather the times of negative growth. Different accounts of knowledge banks can be set up depending on their utilization, ranging from current accounts, to short-term and long-term savings accounts. It is important to realize that such investments can act as a double-edged sword that can negate overall balance in one's knowledge portfolio due to the ripple effect of losing newly acquired knowledge. In this dynamic market of fluctuations in medical knowledge, it is imperative therefore to build and develop conceptual thinking skills.

Conceptual thinking embraces the holistic cycle of understanding, exploration, idea generation, feasibility testing, and action planning. Conceptual thinkers produce ideas about what might be possible, which are then tested using agreed upon feasibility criteria about their potential impact. The criteria come directly from the first "understanding" activity above.

This art of conceptual thinking is exemplified by the story of the grandmaster and the novice who are asked to reconstruct a set game of chess after having visualized it for two minutes. The grandmaster was able to reconstruct the set game almost perfectly, while the novice correctly positioned only three or four pieces. Yet, when the game set was randomly positioned neither the novice nor grandmaster was able to reconstruct the chess board beyond three or four pieces. This highlights how recognizing meaningful patterns is crucial for expertise proficiency and success. These are the keys that serve as the anchoring principles for deducing any given puzzle. Thus, emphasis in medical education must be based on developing these concept maps, leading to strong required reserves in knowledge capital. Such strong reserves will lead to a strong foundation, like a redwood tree that has stood for generations—if the roots of knowledge are strong, what develops will be well-grounded, firm, and long lasting.

Thus, when building an integrated undergraduate medical curriculum one must try to find a balance between misleading oversimplification and counter-productive complexity in medical concepts and information. Creating common ground and a shared understanding can help strengthen the dialogue between the basic and clinical sciences towards building conceptual flexibility in the

undergraduate medical curriculum. Such integration will help erase the compartmentalization of knowledge. The desired goal is to construct a fluid memory-based knowledge of derivatives that is flexible, unconsciously competent, and held by experts, as opposed to hard information that is predominantly theoretical and academic. Creation of a trans-disciplinary web of informational knowledge is to be encouraged, rather than the current practice of compartmental silos of undergraduate medical curriculum.

Furthermore, how do we assure that as programs change and evolve they are mirrored by contemporary changes in assessment and evaluation systems? It is especially troubling because many of these are high stakes examinations with serious repercussions if unsuccessful. Parallel assessments and evaluations of all curricular changes should be part of this cycle of integration reform to achieve a balanced perspective of ongoing curricular redesign.

At the postgraduate level, the Royal College of Physicians and Surgeons is actively involved in integrating CanMEDS as part of the requirements for all residency training programs. At the practice and community level, developing communities of practice and of shared learning are slowly growing. Questions emerging in medical practice include:

1. How do our clients and patients consume readily available Internet-based information? What is the credibility and trust, and how is it established?
2. How does the medical community continue to build a social construct of learning with shared territories of knowledge?
3. How do medical educators move from individual knowledge bank accounts to collective cooperative knowledge, with shared knowledge capital, growth, and dividends?

These practices of integration move to areas of leadership at community, national, and international levels. Yet, one must recognize the advantages and disadvantages that may arise from this structure or process of integration. Such issues may include:

1. achieving balance between structural dilemmas and structural re-engineering;
2. recognizing the complexity that grows with increased fragmentation, including the possibility of losing the whole;
3. recognizing differentiation versus integration and gaps versus overlaps;
4. being aware of under use versus overload;
5. recognizing lack of clarity versus lack of creativity;

6. recognizing excessive autonomy versus excessive interdependence;
7. recognizing a system that is too loose versus too tight;
8. recognizing diffuse authority versus over centralization;
9. being goal-less versus goal-bound; and
10. being irresponsible versus unresponsive (Bolman & Deal, 1997, pp. 60-61).

These issues are well-recognized in business organizations, and lessons learned there can be adapted for usage in the reformed organizational structure and process of medical education. The task of integration is therefore neither easy nor smooth. Such educational reforms would need the flexibility to be workable through multiple frames, such as the structural frame, the human resource frame, the political frame, the symbolic frame, the process frame, and the outcome frames. However, with reframing, realigning, reconstructing, renewing, restoring, and rebuilding, integration can be achieved to form a whole.

THE TEACHING OF PATHOLOGY IN THE MEDICAL UNDERGRADUATE CURRICULUM

The teaching of pathology has changed considerably over the past decade. This section will explore these trends and propose a view of the future.

The Past

Pathology teaching has been presented as formal courses in the undergraduate curriculum in many North American schools. This includes the College of Medicine at the University of Saskatchewan, where two six-credit courses were devoted to the study of general pathology and systemic pathology in the second year of the undergraduate medical curriculum.

In the United States, the total number of pathology curricular hours has decreased since 1986, from a range of 109-418 hours (with an average of 250 hours) to 75-393 (with an average of 188 hours) in 1996-97. This represented an overall reduction of 25% (Kumar, Daniel, Doig, & Agamanolis, 1998). This trend of reduced curricular hours is reflected the University of Saskatchewan, where curricular hours have been reduced from a total of approximately 160 hours to 75 hours over the last few years. Further reduction of curricular hours in the College of Medicine appears to be likely.

The Present

Accurate quantification of the curricular hours of pathology instruction is difficult in many schools because they are being integrated within a multidisciplinary curriculum. The teaching of pathology is mainly being directed to the teaching of clinico-pathological correlation and on the mechanisms of disease. Study trends in the instruction of pathology over a seven-year period (for classes entering 1993-1999) further demonstrate the steady shifts in the instruction of both systemic and clinical pathology from discipline-based courses to integrated joint courses, multidisciplinary systems courses, or case-based formats (Kumar, Indurkha, & Nguyen, 2001). This is also supported by a move towards various forms of active teaching strategies in both large and small group formats rather than the traditional lecture-based format (Kanthan & Mills, 2005, 2006). Adjuvant complementary use of many electronic formats that has also been added as educational resources in our school (Premkumar & Kanthan, 2006).

The Future

Integration is considered an important strategy in medical education. The changes over time include moving from: (a) being content-oriented to learner-oriented, (b) traditional contact hours to reduced contact hours, (c) exclusive information in a supreme elitist group to an explosion of readily available information in a socially pervasive group, (d) rigidly prescriptive individual subjects to a melded inter-subject approach, and (e) a distributed departmental model to a unified centralized model. In this changing landscape where education is a major and expensive social service, it remains the collective responsibility of society as a whole to set the broad goals of education. Integration constitutes the cornerstone of medical curricular redesign. Continued reviews of history, usage, and practices will help broaden or narrow and further redefine the scope of such curricular designs while respecting their underpinning values.

Pathology is an essential discipline that provides students with a solid scientific framework for the understanding of all disease states. Pathology is central and integral, with far-reaching tentacles into other disciplines of medicine, as represented in Figure 2.2. The traditional undergraduate curriculum usually concentrated on the basic sciences in the first two years, then incorporated the clinical sciences and clinical training in latter years. As a bridging discipline, the teaching of pathology is poised to be the gateway for the integration of basic sciences and clinical disciplines. In an integrated curriculum, this would promote a more complete conceptual context for

students, helping them to better understand the application of the basic sciences in clinical medicine.

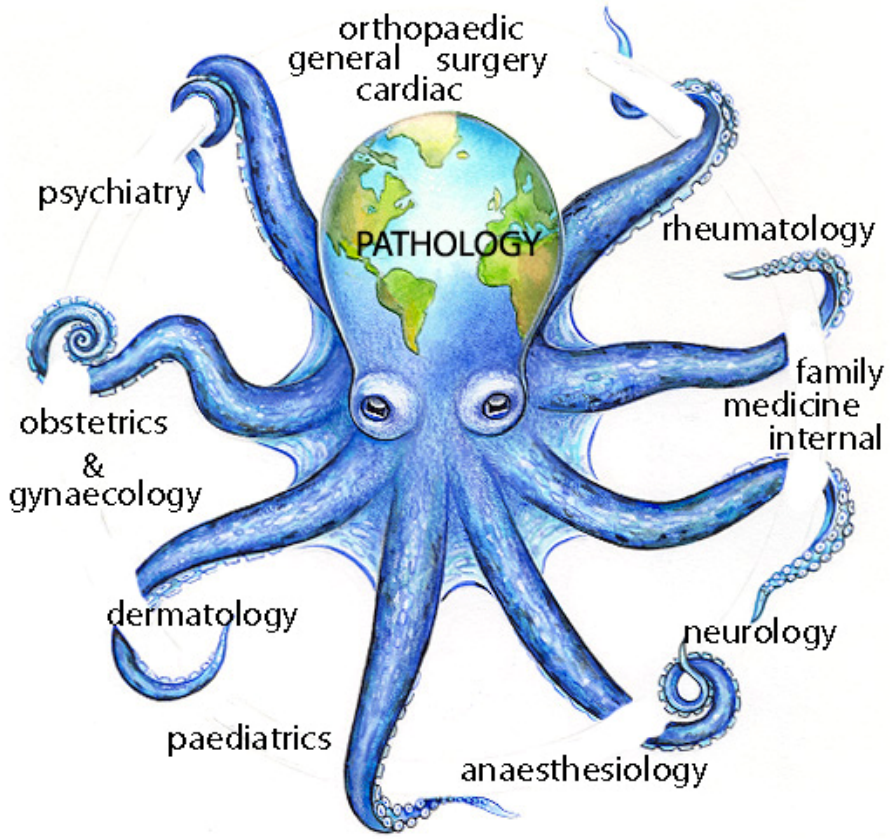

Figure 2.2. The central integral role of pathology in medicine

Although integration with other courses or a multidisciplinary format are perceived as desirable, there is a danger for the loss of each discipline's identity in the face of an increased push for integration. In this context, strengthening the positionality of pathology instruction, from being limited to the first and second years to being taught in all four years of the undergraduate medical experience, is to be encouraged and facilitated. This is the proposed recommended model of integration as a best practice plan for the teaching of pathology in the future. The first step towards this direction has been taken at the College of Medicine at the University of Saskatchewan, where the integration of pathology in various formats encompasses the first three years of the undergraduate medical curriculum. A further representation and reinforcement of cost-effective

laboratory test utilization and test interpretations in the fourth year is being proposed as the next phase of this curricular reframing and redesign.

THEORIES OF CURRICULAR INTEGRATION

In response to various social and educational challenges, modifications to existing curricula are occurring throughout North America and the United Kingdom. Integrated teaching has been suggested as a key tool in the delivery of an effective education program (Harden, Susette, & Dunn, 1984; Schmidt *et al.*, 1996). The undergraduate medical curriculum varies in different schools from a traditional curriculum to a hybrid or a non-traditional curriculum with integrated and interdisciplinary courses. One of the biggest obstacles facing integration is content elimination and quantification of material taught something especially difficult to define and measure (D'Eon & Crawford, 2005).

Harden's Eleven Steps of Integration

Harden (2000) has described an eleven-point integration ladder continuum between the two extremes of isolated and trans-disciplinary instruction. The first four steps of the ladder are predominantly discipline-specific, with isolation, awareness, harmonization, and nesting as representative of the current teachings of the pathology course. The next five steps—temporal co-ordination; sharing of the teaching program; correlation with an integrated case after the students study the topics; a complementary program based on themes, topics, or being multidisciplinary—move towards further integration, transcending subject boundaries with a themed approach to a structured body of knowledge that needs to be mastered. The last two steps of this proposed integration ladder are interdisciplinary and trans-disciplinary integration. In these final two steps the educator provides a framework but the student conducts the integration and constructs his/her own unique individualized understanding within his/her reality and perceptions. This is often referred to as "authentic integration" and reflects the learning that occurs outside of school.

It is interesting to note that such concepts were prevalent in elementary educational literature a decade earlier. Fogarty (1991) described ten ways to integrate a curriculum with pros and cons and worksheets for interested teachers wishing to explore any particular model. This was further supported by others involved in the implementation of curriculum integration by interdisciplinary, thematic, or synergistic teaching (Jacobs 1989; Markus 1991; Shoemaker 1989). Fogarty's ten

levels of the continuum of curriculum integration were fragmented, connected, nested, sequenced, shared, webbed, threaded, integrated, immersed, and networked, and bear many similarities to Harden's eleven-point curriculum integration ladder.

Horizontal Integration of Pathology Teaching

A horizontally integrated curriculum seeks to further break down the distinction between the basic and clinical sciences within the early years of the program. In this model, more clinical focus is adopted to introduce clinical features within the basic sciences. Horizontal integration also includes temporally aligning the teaching of related topics or themes within both the curriculum and their specific discipline boundaries (Vidic & Weitlauf, 2002). The integration occurs within the same year. In the teaching of pathology in the first year at the College of Medicine, there is a single horizontally integrated component (Path 201.3) that complements the modular themes being taught in the integrated forms and function course (ITDL 206.18). In the second year, the systemic pathology is temporally aligned with the systems teaching to complement the understanding of the pathogenic mechanisms of diseases related to these systems, such as gastrointestinal, cardiovascular, hematology, and reproductive systems.

Vertical Integration of Pathology Teaching

A vertically integrated curriculum seeks to bridge the preclinical and clinical divide in content by teaching the content concurrently rather than sequentially, yet still retaining discipline boundaries. The predominant aspect of vertical integration is content integration with basic sciences and clinical subjects (Vidic & Weitlauf, 2002). The integrated form and function course (ITDL 206.18) is an example of modular thematic vertical integration of the basic sciences including anatomy histology, physiology, and embryology. Such content can also be connected year by year with a vertical theme. In a similar vein, core general pathological principles are vertically integrated in strategic modules to facilitate student understanding of the relevance of their basic science content. However, as this process increases, quantification of these instructional hours of pathology teaching will be difficult and tedious.

Proposed "Diagonal" Integration Concept of Pathology Teaching

The teaching of pathology can only be improved by taking advantage of the opportunities for curriculum enhancement as they occur. Pathology can introduce and reinforce concepts in multiple contexts through ongoing and shared responsibilities and commitment in many different basic sciences and clinical disciplines. Curriculum planning should remain focused on realistic student learning outcomes rather than on disciplinary traditions and faculty preferences. Furthermore, overcoming the domination of individual academic disciplines can mitigate against the integration of knowledge with insights from different fields.

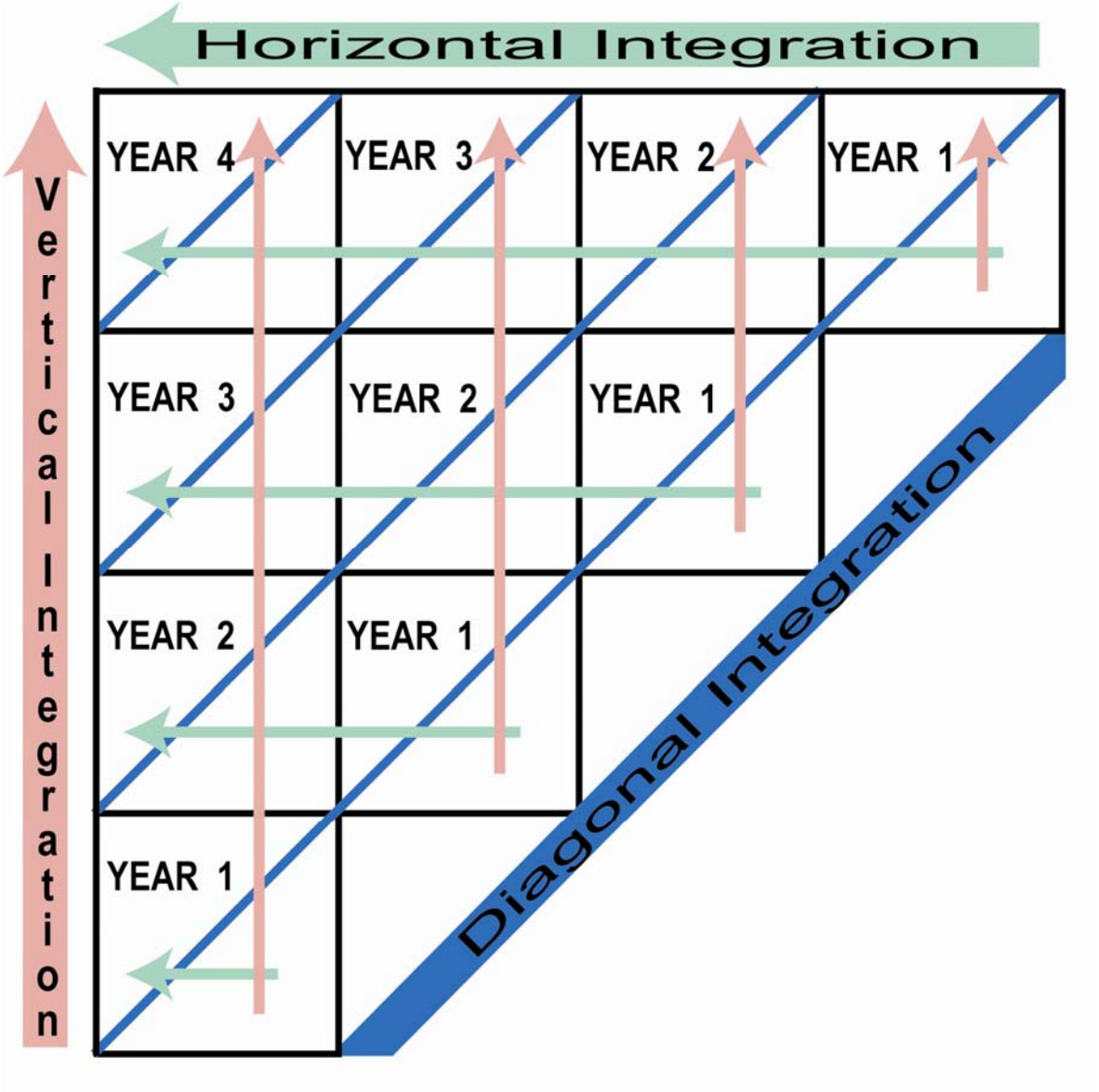

Figure 2.3. The concepts of vertical, horizontal and diagonal integration

The recommended method proposed in the future plan of pathology teaching, therefore, is a diagonal integration of pathology within the given matrix of vertical and horizontal integration. This would occur throughout the four years of the undergraduate medical curriculum, with reinforced key elements of integrated inter- or trans-disciplinary learning environments, wherein the student can construct his/her own true understanding in real world situations.

This symbolic color-coded representation serves as a conceptual framework for the concepts of vertical (pink), horizontal (green), and diagonal (blue) integration of pathology teaching in all four years of the undergraduate medical curriculum.

THE STUDENT LEARNING ENVIRONMENT

This section explores the literature related to the student learning environment with regards to the constructivist approach to learning. Surface and deep learning, as related to the role of pathology teaching in the development of knowledge networks, will also be addressed in this section.

What is the Learning Environment and the Learning Climate?

The educational or learning environment is an increasingly recurrent phrase in medical education. The learning environment has been used to include all settings wherever student learning occurs. Such environments that are embedded with both formal and informal curricula can provide a matrix that nurtures or inhibits learner growth. Genn (2001) proposed that the educational environment is perceived by the students and these perceptions are the key determinants of student learning behavior: “This environment as perceived was designated the learning climate. It is argued that the climate is the soul and spirit of the medical school environment and curriculum. Students experiences of the climate of their medical education environment are related to their achievements, satisfaction and success”.The terms learning environment and learning climate are used interchangeably. Taking its cue from Genn, this study is focused on student perceptions of the learning environment as experienced.

The medical school is a learning organization that evolves and changes in accordance with the evaluation (i.e., research studies) of its environment. It is important to remember that in this organizational educational environment of learning and teaching, the two key players are the

medical students and medical educators. Thus, perceptions of both these groups are important for a true representation of the learning climate of the medical school.

Theories of Learning

Two characteristics of medical knowledge are that it is immense and constantly changing. Health professionals must acquire and remember a tremendous number of details, making memory processes critical. Theories of learning that focus on memory, including general theories of cognition (Anderson, 1976) and learning process theory (Craik and Lockhart, 1972), are applicable to knowledge construction and recall of information in medicine. Cognitive flexible theory (Spiro & Jehng, 1990), which emphasizes a case study approach involving context-dependent and realistic situations, applies directly to medical education. The use of learning strategies to maximize study behavior is also very important.

Certain cognitive processes and skills are critical in medical practice (e.g., decision making and reasoning), which suggests that problem solving must be part of the basic pedagogy for medical curricula. Problem-based teaching styles that emphasize problem solving in particular have been the basic pedagogy for many medical curricula (Norman & Schmidt, 1992). Healthcare workers are frequently required to make important value judgments, and so research on attitudes is also relevant.

Medical education extends over the lifetime of the individual. Healthcare practitioners must be self-directed in their learning activities and be able to relate new information to their individual professional needs and experiences. For this reason, theories of adult learning that emphasize self-directed and experiential learning are also relevant (Cross, 1981). Furthermore, theories of criterion referenced instruction that are based upon self-study or the use of media (Mager, 1984) are also significant to medical education.

Constructivist Approach to Learning

Learners integrate new ideas with prior knowledge to construct their own meanings (von Glaserfield, 1989). This begins with simple unsophisticated models that later, through self-reflection, can become increasingly complex models. According to traditional behaviorist educational principles, assessment performance controls the curriculum because the amount of learning that a student can demonstrate is a product of their teaching (Dornan, Arno, Hadfield, Scherpbier, & Boshuizen, 2006). However, in reality assessment performance is determined mainly

by the students' ability and effort as they "learn to the test" irrespective of their quality of teaching (Jolly Jones, Dacre, Elzubeir, Kopelman & Hitman, 1996). It is more important to find out what happens to the student because contemporary educational theory gives students considerable responsibility of managing their own learning. The importance of the current student learning activities, including relevance of curricular content to their future practice, is now emerging as a crucial determinant in curricular planning and discussions.

Knowledge Construction and Application in Medicine

In the cognitive domain of knowledge, comprehension and application are viewed as a sequence of progressive contextualization of the material based on Bloom's taxonomy, as illustrated in Figure 2.4.

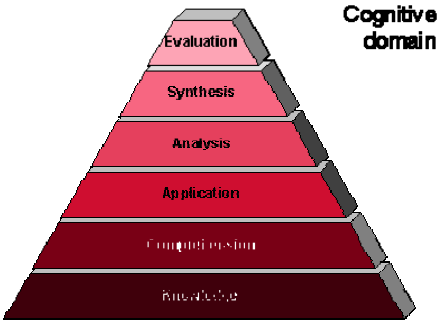

Figure 2.4. Bloom's taxonomy of cognitive domain

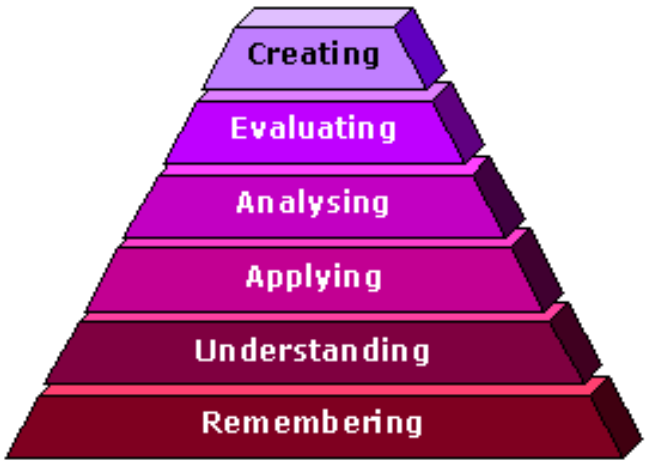

Figure 2.5. Anderson and Krathwohl's revised taxonomy

Figure 2.5 depicts Anderson and Krathwohl's (2001) revised taxonomy of the cognitive domain, which is in current vogue due to its increased emphasis on creating one's own understanding of knowledge by continued application, analysis, and evaluation of a learned skill or competency, rather than the application and analysis of a previously constructed body of knowledge.

It is now accepted that the key to sustainable knowledge with recall memory construction is designing an engaging learning environment that begins with "the end in mind," as seen in the familiar problem solving strategy central to curriculum development. Engagement of the learner is affected by both their motivation and perception of relevance. Motivation can be extrinsic (such as assessments or exams) or intrinsic (desire to learn or relevance). The relevance of learning is closely linked to motivation, and is a crucial element in curricular content design. Content that is important and meaningful to roles and tasks in the near future and content that is pertinent to future courses and academic tasks are considered as key criteria in deciding curricular content.

The goal of the revised medical curricula is to provide learning environments where students are engaged in authentic and multidisciplinary tasks. Such environments result in the instructor being a facilitator to the student, who learns through engagement, exploration, and interaction. "Content stuffing" of the curriculum must be discouraged (D'Eon & Crawford, 2005). Strategies such as concept mapping with the construction of concepts, rather than rote factual memorization, should be incorporated both in teaching strategies and assessment of the tasks. Such techniques would promote a construction of understanding so that students would be able to transfer and transform knowledge as needed to the situation.

Surface and Deep Learning

The terms surface (or shallow) and deep learning refer to student approaches to learning, as described in the pioneering work of Marton & Saljo (1976a, 1976b). Both deep and shallow learning are about the aim of the learner and the width of the aspect being learned. Surface learning refers to a predominant process of learning for a particular task rather than grounding it more richly with relationships to other aspects. This promotes rote learning of the content with no real understanding of meaning and interconnectedness. The key motivation in surface learning is a fear of failure and a tendency towards a reproductive orientation to study tasks. By contrast, deep learning refers to the process of incorporation of new ideas within existing knowledge frameworks.

These relate to individual experiences and are motivated by an interest in learning for its own sake. The deep and surface learning experience is rooted in whether the learner's goal is to understand (deep learning) or to perform well on some specific anticipated test task (surface learning). This is because "understanding" has no true endpoint. There is always more that could be done because there are always more connections to make, more applications of a concept to work out. There are numerous kinds of such connections, and the more links that are made, the greater the likelihood of retaining this knowledge for future use. Making these connections takes time: time to think, and perhaps time to discuss it with others to prompt further thinking and strengthening of the networks of connective knowledge. This also promotes lifelong learning practices (Downes,2006)

Deeper learning occurs in curricular designs that will (a) facilitate more student-centered teaching; (b) have clear learning goals; (c) provide some student choice in what is learned and how it is assessed; (d) provide a positive social learning climate; (e) ensure academic, authentic, and genuine relevance of courses; (f) provide opportunities for personal contact with the teacher and (g) discourage heavy workload and undue emphasis on classroom didactic instruction. It is apparent that medical education strategies should promote deep learning to be effective over the career of the physician, who should be an independent self-directed learner. The goal, therefore, is to depart from a teacher-centered content-oriented learning environment to a student-centered learning-oriented environment. Accordingly, static teacher dominated learning environments have to change from being predominantly knowledge transmission to dynamic and interactive student-teacher environments, with knowledge gathering working with conceptual thinking. This would facilitate the development of skills that can transform, adapt, and restructure solutions based on the conceptual principles constructed, and thereby facilitating self intellectual growth. (Entwistle & Ramsden, 1983; Kember & Gow, 1994; Knapper, 2000, 2004, 2006).

Learning and understanding are an extremely complex process with multi-factorial variables that are all interconnected in the construction of knowledge banks. Learning, however, must never lose its place as the central dominant function of all education. Congruence between curriculum goals and student perceptions of their learning environment will also facilitate integrated curricular interventions.

Development of Knowledge Networks

Deep and surface learning can be viewed as different motivations for a learner (extrinsic versus intrinsic) or as different methods (or study skills or strategies). Learning, however, is an internal, unobservable process that results in changes of belief, attitude, or skill. Knowledge building, by contrast, results in the creation or modification of personal and public knowledge—knowledge that lives "in the world" and is available to be augmented and used by other people.

The creation of public knowledge results in personal learning, but so does practically all human activity. Results to date suggest that the learning that accompanies knowledge building encompasses foundational learning, sub-skills, and socio-cognitive dynamics. Keeping abreast of advancing knowledge is now recognized as essential for members of a knowledge society.

Knowledge building goes beyond this to recognize the importance of creating new knowledge. The key distinction is between learning—the process through which the rapidly growing cultural capital of a society is distributed—and knowledge building—the deliberate effort to increase a society's cultural capital. Knowledge building has been shown to yield advantages in literacy, core content knowledge, and the ability to learn from text, to name only three. However, that knowledge building involves students directly in creative and sustained work with ideas makes it especially promising as the foundation for education in the knowledge age. It is this creation and knowledge building in students' own understanding that is at the top of the pyramid in Anderson's revised taxonomy of the cognitive domain (Figure 2.5), in contrast to the static knowledge pool at the base of the pyramid in Bloom's taxonomy (Figure 2.4).

Integration erases the compartmentalization of knowledge by breaking down the artificially structured silos of discipline specific knowledge. The aim is to help learners construct a fluid memory based on the knowledge of derivatives that is flexible, tacit and held by experts –as opposed to hard information that is rhetorical, theoretical, and book-based, thus avoiding memory in silos/compartments.

The ultimate goal of curricular integration in medicine is the development of knowledge networks by creating a trans-disciplinary web of informational relationships. Such networks begin with the acquisition of information and the flow of messages that increase existing knowledge by restructuring and modification. This information is the sphere of common understanding, but subjective in nature relative to its owner, who constructs their own reality and representation. The

integration of knowledge as an object of a continuum is a common phenomenon in collaborative medical diagnosis.

Pathological concepts are the building blocks upon which all diseases are fundamentally diagnosed and treated. The diagonal integration of pathology teaching throughout the undergraduate curriculum is proposed as the best practice plan of curricular instruction of pathology in the integrated curriculum.

CONCEPTUAL FRAMEWORK OF THE STUDY

The objective of this research is to investigate the advantages and disadvantages of horizontal and vertical integration models for the teaching of pathology through an analysis of the perceptions of individual faculty medical educators and first- and second-year students in the undergraduate curriculum at the College of Medicine at the University of Saskatchewan.

This literature review has identified four major areas to provide an understanding of how the teaching of pathology should be integrated in the undergraduate medical curriculum. These four pillars of understanding are: (a) concepts and understandings of integration in medicine, (b) theories of curricular integration, (c) beliefs of effective pathology teaching practices, and (d) the learning environment shaped by student and teacher perceptions.

At a minimum, it is the combined understandings of these four areas that will contribute towards developing an integration plan for the most effective teaching of pathology in the undergraduate medical curriculum, as illustrated in Figure 2 .1 The best practice of curricular instruction of pathology in the undergraduate medical curriculum would probably be at some point in a continuum between the polar ends of the debate from a traditional to a nontraditional curriculum, determined more precisely by constraining organizational practices of the learning institution.

CHAPTER 3
Research Design and Methodology

INTRODUCTION

The purpose of this study is to enhance pathology instructional pedagogy by investigating the advantages and disadvantages of the models of horizontal and vertical integration in the re-organized structural teaching of pathology. This research is a comparative and descriptive study of participant perceptions based contextually within the proposed framework of the newly designed curriculum in the College of Medicine at the University of Saskatchewan. The study participants include individual faculty medical educators and first- and second-year students in the undergraduate curriculum from January 2006 to May 2007.

This chapter will begin with an introduction of the type of inquiry utilized in this study, including a description of program evaluation. An explanation will be provided for why the monitoring category of program evaluation has been chosen for this study, followed by a discussion of the research methodology, specific tools, and processes employed in this study. Finally, the ethical considerations for this study will be outlined.

PROGRAM EVALUATION: THE OVERVIEW

Program evaluation is an empirical analysis of a program's performance that is supported by the collection and analysis of evidence (Owen & Rogers, 1999). These judgments are often used in decisions that involve different aspects of a program, including the future direction and resource allocation of a program's design, delivery, and outcome.

In the 1960s, program evaluation projects arose in response to a perceived need in the United States to better understanding the actual effects of the military Great Society projects (Great Society, 2006; Unger 1996). Program evaluation uses scientific methods that are largely social, providing empirical evidence of the impacts, outcomes, and effects of public policies, which are in turn intended to be used as inputs for decision-making (Orosz, 2001).

Evaluation begins with the impacts and outputs of the organization, and may move inward to examine the operational reasons for both the input and output results. Program evaluation has developed its own set of standards for measuring performance. It maintains a traditional connection with program managers and planners, emphasizing objectivity over independence (Owen & Rogers,

1999). In practice, evaluators are increasingly being asked to comment on the impacts of particular structures or systems on the attainment of objectives. These judgment calls can be powerful tools in final decisions regarding the very survival of a program. The inherent danger is the possibility that the evaluation influence the program's strategic decision-making and planning.

Categories of Program Evaluation

Evaluation can be conceptually classified into the following five categories:

1. Proactive: evaluates the program prior to its actual design. This usually involves policy development that includes research, best practices review, and needs assessment.
2. Clarificative: clarifies the program design for the professed outcomes with logic development and accreditation practices.
3. Interactive: provides information about delivery or implementation of a program by a responsive, action research, quality review, developmental, or empowerment evaluation.
4. Monitoring: evaluates and monitors an ongoing program.
5. Impact: assesses the impact of the program, which may include endpoints such as outcomes, accomplishments, products, or consequences. These help decide the merits or demerits of the program and utilize strategies such as a needs-based evaluation, process outcome studies, or a performance audit (Owen & Rogers, 1999).

As curricular changes in pathology teachings have already been implemented, evaluating the perceptions of students and faculty to this aspect of the program will be undertaken using the monitoring component of program evaluation.

Monitoring: History, Trends, and Theory

This section will address the history, trends, and theoretical aspects of monitoring evaluation. Monitoring is the most appropriate form of evaluation to be undertaken when a program is well established and ongoing, with specific goals, identified targets and tangible outcomes. It is also suitable as a rapid evaluation tool when new changes are being implemented. Typical issues that are studied include:

1. Is the program reaching its target population?

2. Is the program meeting its benchmarks of delivery and specified outcomes?
3. Is the program achieving its desired effect over the specified time?
4. Is this a financially feasible implementation strategy?
5. Can the program be fine-tuned to promote more efficient delivery?
6. What steps can be taken to make the program more effective?
7. Are there any differences between the various sites/forms of implementation?

In the monitoring form of evaluation, evaluators are most likely to be internally located in large-scale organizations (in-house evaluators). Such an evaluation is short-term and the evaluation findings can be independently published with no higher level editing and policing.

Short-term evaluation mechanisms have evolved from an understanding of some of the pitfalls of traditional program evaluation, which: (a) are usually lengthy (two years or more); (b) involve outside contracts or firms; (c) require large amounts of money; and (d) result in the production of thick, jargon-laden reports that usually remain unread. In contrast, the independent, timely, user-friendly reports of the short-term evaluations can provide:

1. benchmark data for subsequent reviews;
2. an indication of performance against a predetermined standard (Wholey, 1983);
3. ideas for discussion at the program policy level to facilitate decision making:
4. ideas for improving the quality of services; and
5. ideas to make services more efficient and effective as the evaluation topics are targeted and focused on "specific topics of current interest and thus have a good chance of being influential" (Mangano, 1990, p. 34).

The creation of "such rapid, responsive evaluation targeted to decision makers is increasingly becoming more important to improving the quality, efficiency, integrity and the cost of programs," as is evident at the U.S. Department of Health and Human Services (Mangano, 1990, p. 25). Monitoring evaluations are part of the total quality management and quality assurance movements, with outcomes typically utilized for decision-making and accountability purposes in the private and public sectors.

This monitoring process can be three-fold (Owen & Rogers, 1999):

1. The evaluation may involve the development of a system of regular monitoring of program progress through common evaluation procedures across the organization at multiple sites or to a targeted population. This is termed systems analysis of the mega program or the giant P (program).
2. Regular performance assessment of all components of a program on a regular basis with reports generated to senior management, who use this to make judgments of each component in relation to the overall mission and goals of the organization. This is done with a set of quantitative performance indicators against which progress can be charted. This is the devolved performance assessment of the macro program or the big P (program).
3. A single component of the program is selected for focused targeted systematic analysis. This is termed component evaluation of the micro program or the little P (program).

These are the three key approaches of monitoring evaluation.

Single component program evaluation is widely used in studying focused aspects of the medical curriculum, such as the learning environment, as found in the Dundee Ready Education Environment Measure (DREEM) (Roff, 2005) and the Medical School Learning Environment Survey (MSLES) questionnaires (Henzi *et al*., 2005). Such evaluation strategies are best suited to evaluate outcomes rather than operational outputs, such as cost effectiveness. The specific outcomes monitored can include objectives achievement and the impact of the program (Casley & Kumar, 1989; Patton, 1986).

Interpretation of program evaluations to provide recommendations is facilitated by the inside evaluator's knowledge of the program's general dynamics and operational outputs. This understanding permits the evaluator to analyze the outputs in the context of the program's rationale and theoretical framework to postulate reasons for the program's success or failure. This is one of the unique advantages of a monitoring evaluation of a micro component of the program.

The proposed study involved the targeted focused evaluation of one component (the organizational structural delivery of pathology teaching) within the newly revised, restructured, and redesigned undergraduate medical curricular program at the College of Medicine. This component has been identified as the focal point of the study to monitor whether the new organizational structural delivery of the pathology teaching is effective in terms of student learning satisfaction and

faculty teaching satisfaction. This is in keeping with the goals of the University as it moves towards an overall integrated plan of education and healthcare.

The structural reorganization and delivery of this component of the program is an ongoing rather than discrete event, and is therefore subject to non-controllable organizational, political, bureaucratic, and fiscal factors. Therefore, the program component being monitored can be reorganized or even deleted during the monitoring process.

Typically, as the major focus of program monitoring is delivery and outcomes, evaluation data have been traditionally obtained through quantitative performance indicators that address three broad areas of:

1. Program effectiveness - the match between program outcomes and objectives (Wells 1986).
2. Program efficiency - the relative cost of achieving desired positive impacts.
3. Program appropriateness - the match between program objectives and current community and government priorities.

Thus, there is a growing trend that supports the notion that data management in any evaluation is not just a matter of statistics (Owen & Rogers, 1999; Patton 2002).

The assembly of evidence for monitoring requires and benefits from a range of techniques that includes both quantitative and qualitative data. It is now accepted that mere adherence to numbers as the performance indicator does not mean program effectiveness (Winston, 1991). Thus, for an overall holistic view of program appropriateness, efficiency, and effectiveness, quantitative data needs to be supported by qualitative descriptive data that address participants' perceptions, experiences, and environments within the related contextual knowledge. Such qualitative data may be the only avenue wherein unintended outcomes may become apparent. Such outcomes may reflect a positive or negative trend. Furthermore, if too great an emphasis is placed on just the quantitative performance indicators, those outcomes not amenable to measurement by this technique may be lost, resulting in goal/objective displacement (Owen & Rogers, 1999). Using a multiplicity of data collection strategies can help avert such phenomena. In this study, evaluation of student perceptions was not limited to quantitative data from a survey questionnaire. An added opportunity to explore issues not addressed in the survey questionnaire or concerning any new and unrelated or unintended outcomes was provided through focus group interviews.

The ever-present problem of interpretation is in determining attribution. This is usually the most difficult yet the most important issue to be addressed in the evaluation, for what appears to be an obvious connection may, in fact, not be valid within the scope of the study.

The evaluation landscape is diverse and offers many different forms and variations of approaches or types. Traditionally, scientific evaluations are based on "hard" numerical data, conforming to a strict methodology and usually conducted by an outside neutral expert in evaluation methods. Current trends encourage a more participatory evaluation practice based on multiple factors, including hard numerical data and people's perceptions (so-called "soft data"). The evaluators are usually experts in the subject matter at hand and actively involved (participatory) in the project, providing regular feedback to improve the project and using the results to make decisions about future changes. Evaluation data can therefore be analyzed by qualitative and quantitative evaluators, formative (to help develop a new program) and/or summative (to assess the overall effectiveness of an operating program) evaluators, pure researchers, or field practitioners, each adapting techniques designed to their specific environments and based on their individual contextual backgrounds (Orosz, 2001; Owen & Rogers, 1999; Patton, 2002).

RESEARCH METHODOLOGY

In the current contextual framework of this study, a triangulation of research methodology, including multiple data sources, subjects, and data collection techniques, will be employed (Bogden & Bilken, 2006). This should increase the study's validity (i.e., Does the data measure an outcome solely related to this program?) and reliability (i.e., How accurate are these data? Are the data true measures of the index?) Yet, in educational research, decision-making and research do not exist in a one–to-one relationship, as evaluations are difficult to be linked to explicit educational goals of learning and understanding. Therefore, employing a variety of evaluation methods that can provide different perspectives is extremely useful in increasing the basis for decision-making at many levels (Lundgren, 1978).

This study will use comparative quantitative and qualitative research inquiry techniques to identify the advantages and disadvantages of the newly integrated teaching of pathology in the medical curriculum. The study data collection was limited to a five-month collection period (January 2007 to May 2007).

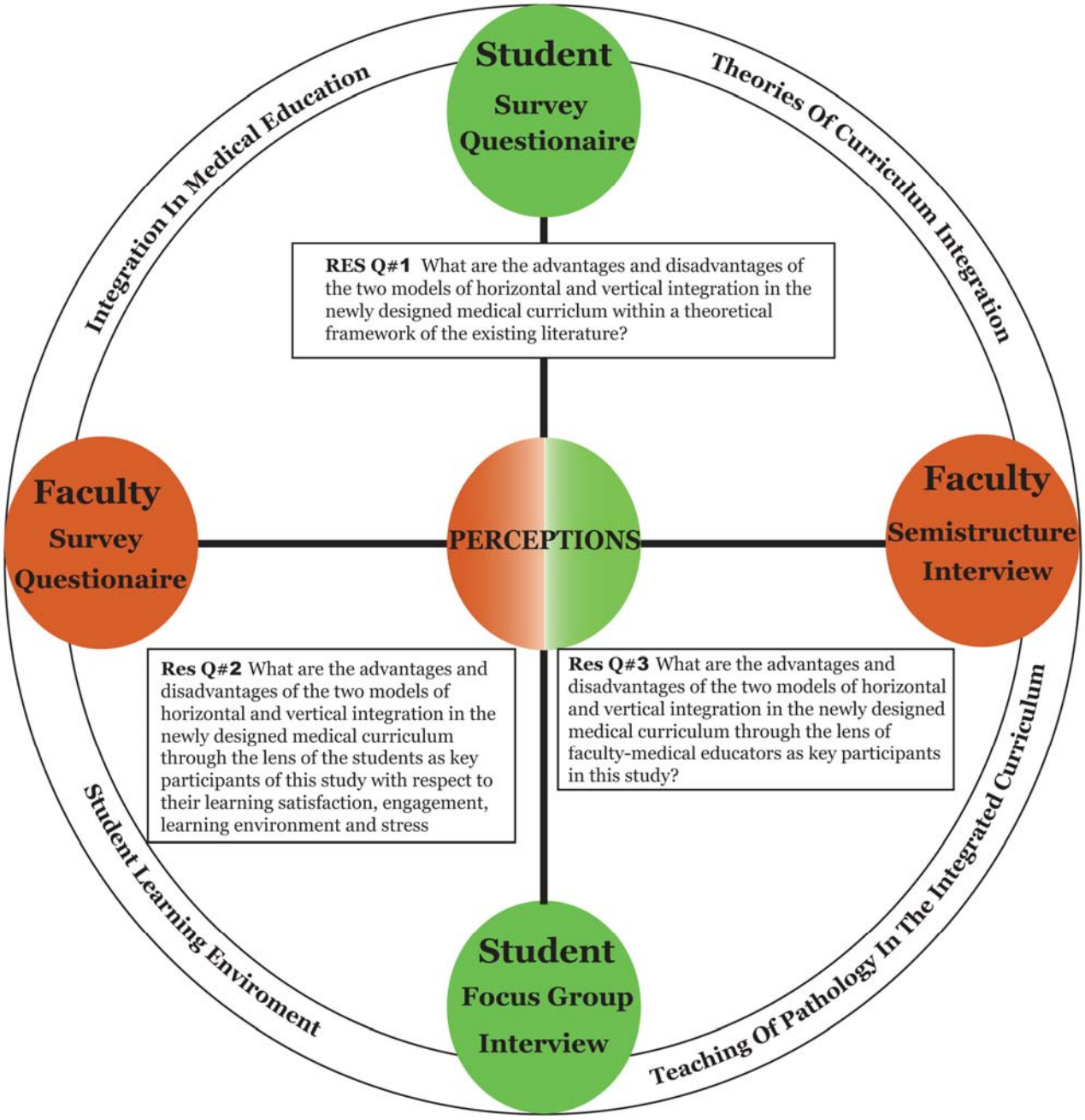

Figure 3.1. Conceptual framework of the research methodology

As perceptions are not fixed, this study employed as data gathering tools structured and semi-structured open-ended questionnaires for students and faculty participants, focus group interviews for student participants, and in-depth conversational interviews for faculty participants. In Figure 3.1, this research methodology is set contextually within the three research questions of this study and in their theoretical literature background.

Student Participants

All students registered in the first year (approximately ninety students-medical and dental) and second year (approximately sixty medical students) undergraduate medical curriculum at the College of Medicine at the University of Saskatchewan were invited to participate in this study. The first-year medical and dental students were the first cohorts to experience the newly designed integrated curriculum. The participation of medical students from the first and second year served as a comparison cohort to monitor any changes in perceptions that may be attributed to increased maturity, comfort, and/or process familiarity with the medical system. The second-year students' perceptions are based within their prior experiences of a traditional non-integrated first year medical curriculum.

Faculty-Medical Educator Participants

Four faculty members who participated in the teaching of the newly integrated medical curriculum voluntarily participated in this study. The inclusion criteria for the participants were: (a) to be a current faculty member at the College of Medicine at the University of Saskatchewan, and (b) to have taught in the newly integrated undergraduate medical curriculum since its inception in August 2006. Faculty who participated in the teaching of the modules during the study period were especially encouraged to participate in this study. In this context, the ideal faculty educator pursued for this study included the module co-ordinators and systems co-ordinators that had overall responsibility for the delivery of the course and were cognizant of the implemented changes. This represented a mix of perceptions, from non-medical trained Ph.D. faculty and medically trained clinician educators. While it would be have been interesting to compare differences in responses between the research oriented non-medical educators and their medical clinician counterparts, this was not carried out due to the limited sampling.

Data Collection

The methodologies included the use of both quantitative, objective data and qualitative, subjective data (i.e., perceptions). The design included data collection with repeated sampling over time at different parts of the course (January to May 2007) and cross-sectional data collection at the same point in time but in different courses.

Survey Questionnaire

Surveys are systematic ways of collecting primary data from persons associated with a program. Surveys are used extensively because of their versatility. However, developing a survey for use in an evaluation requires care, expertise and respecting the following three-step guideline: (a) defining the evaluation needs; (b) developing the survey; and (c) pre-testing the survey to provide clarity of questions, response rate, time and length, and the ideal method of survey administration. Surveys are ideal for collecting data on almost any aspect of a program in both small and large target populations. However, survey procedures have several drawbacks that can threaten reliability and validity of the data collected, such as: sampling bias; non-response bias; sensitivity of the respondents to the questionnaire; interviewer bias; and coding errors (Babbie, 1973; Rossi, Wright, & Anderson, 1985).

Student Surveys

Student survey questionnaires for the first-year medical and dental students in the vertical and horizontal integrated teachings of pathology (Appendix 3.1 & 3.2) and for the second-year medical students in the horizontally integrated course (Appendix 3.3) were designed to assess the potential effect of pathology teaching in the integrated curriculum. The survey questionnaire tool is best suited for capturing the perceptions of a large number of students because it is easy to administer and is usually rapid and responsive. This questionnaire was specifically designed to provide answers to this study's research questions. It was been modeled on the two well-known and widely used survey questionnaires used amongst medical and dental students, the DREEM (Roff, 2005) and the MSLES questionnaires (Henzi *et al*., 2005).

The process of designing this questionnaire was fivefold:

1. identification and clarity of the concepts being evaluated to help answer the research questions;
2. formatting the questions (open versus closed response) and specifying the response scales to ensure validity of the measurements;
3. wording and construction of the question to provide clear communication, free from ambiguity and bias;

4. deciding the order and layout of the questionnaire to ensure that interest is retained throughout the questionnaire, and avoiding order bias of questions that might lead to predetermined conclusions; and
5. pilot testing of the questionnaire to detect ambiguous questions, poor wording, and omissions.

Medical educators and colleagues reviewed this questionnaire for content and form. A pilot run of this questionnaire was conducted on a group of third-year students who were not participants in this study. The questionnaire was designed with 45-48 questions, a range that seemed necessary for maintaining construct validity of the items (Roff, 2005; Henzi *et al*., 2005). The item questions in this survey were specifically designed to collect data concering:

1. student perceptions of the horizontal and vertical integration of pathology teaching (items 3, 31, 32, 33);
2. student learning satisfaction from this process (items 4, 7, 9, 15, 18, 39, 41);
3. student perceptions of the effectiveness of this integration of pathology teaching (items 5, 6, 10, 11, 13);
4. student perceptions of the learning environment (items 16, 17, 21, 22, 27, 30, 34, 35, 36, 37, 40, 42, 45, 46);
5. student academic self-perception (items 12,14, 19, 20, 23, 24, 25, 26, 43);
6. student overall perceptions of learning—the relevance and effectiveness of knowledge and skills received (items 1, 2, 8 , 28, 29, 38, 44, 47);
7. student engagement (items 19, 20, 23, 39); and
8. student stress (items 16, 28, 44).

While there are varying views in the literature with respect to the use of negatively phrased survey items (Stewart & Fyre, 2004), it was decided to include four reversed-item questions (items 15, 30, 31, and 46) in these surveys to avoid item bias and predetermined response. A Likert scale of graded responses was used rather than a simple “yes or no” format to allow for a range of responses because perceptions are not a fixed practice. A five-point Likert scale range was chosen because many studies support this format and it provides ease of data analysis (Roff, 2005;

Jameison, 2004). For the most part, the quantitative analysis of data for this study was conducted from these survey questionnaires.

These self-developed questionnaires were not tested in a non-research setting. However, the general format of the survey was modeled on established questionnaires, such as DREEM and MSLES. The questionnaire was administered to approximately 150 students at different time intervals, providing both cohorts of comparison data within and between the groups to assure a fair degree of test-retest reliability and inter-observer reliability. Comparison of the scores was conducted to provide some evidence of parallel forms of reliability. The data obtained were reduced by factor analysis with principal component analysis by Varimax rotation to an Eigen value greater than 1 (Stat Soft Electronic Textbook,). Factor analysis was applied to determine which variables "form coherent subsets that are relatively independent of one another" (i.e., factors combine variables that are highly correlated to one another) (Tabachnick & Fidell, 2001). If several variables correlate highly, they might measure aspects of a common underlying dimension called factors. Furthermore, greater loading of variables on a factor suggests that the factor explains relationships between those variables. Content validity was further established by factor identification of the principal constructs tested in the study. This further validated the item construction of the survey questionnaires. Cronbach's α scores measured internal consistency. Average inter-item correlation for theme-related questions designed were undertaken to measure the same construct and establish convergent validity of the item measures.

Besides these structured questions, four open-ended questions were available at the end of each survey questionnaire to provide an opportunity for the participant to freely discuss any phenomena that may have occurred due to this change, to provide any positive or negative feedback, and to offer suggestions and recommendations for improvement.

First-Year Medical and Dental Students.

These questionnaires were administered in class at the end of the vertically integrated modules (x3) in the first-year course, ITDL Forms and Functions (206.18). The same students (medical and dental) also had an opportunity to complete these questionnaires at the midway and end of the horizontally integrated pathology course 201.3 (x2). This group of students participated in the survey questionnaires at five different time frames during the same period of the study. It was assumed that this would capture the perceptions of a similar cohort of students who had experienced

both horizontal and vertical forms of integration during this time frame, thus providing answers to Research Question #1.

Second Year Medical Students.

The survey questionnaires were administered to the second-year medical students in class at the completion of each system (x3) in Pathology 302.9.

Student Content Assessment Outcomes

Formative (ongoing in-course assessments) and summative (end-of-module exams, midterm exam, or end-of-course exam) at the end of the vertically integrated ITDL 206.18 and the horizontally integrated Pathology 201.3 as posted for grades and promotion were collected from the College of Medicine for the first-year medical and dental students.

Similar formative and summative assessments were also collected for the second-year medical students at the end of the study period for the horizontally integrated systemic Pathology 302.9.

Student Focus Groups

Focus group interviews were arranged with voluntary participants for the first- and second-year students to further capture, discuss, and explore any evolving trends. The survey questionnaires served as a guide/baseline for the in-depth semi-structured interview. The participants were encouraged and invited to share any self-reflections and positive or negative comments.

The focus group interviews were administered through the Education Support and Development (ESD) at the College of Medicine. A typed report was generated from these interviews for analysis and interpretation. The researcher was not involved directly in these proceedings to avoid any possibility of position of power conflicts.

Faculty/Medical Educator Survey

A semi-structured questionnaire (Appendix A-3.4) was been designed to initially guide the faculty medical educator participants through: (a) the key areas of integration (items 1-5); and (b) the integrated learning environment (items 6-10). The discussion was then opened up for participants' experiences to produce theoretically informed accounts of their perceptions, with a

critical analysis of the categories and forms. The survey questionnaire had ten structured items and one open-ended question for comments, suggestions, and observations. This was given to the faculty participants ahead of their in-depth interview to facilitate familiarity and generate a healthy and focused discussion on the research topics of interest.

Faculty/Medical Educator Interview

Semi-structured interviews (interviews in which the same general questions or topics are raised to each of the key informants) seek to acquire comparable data from participants using a list of general questions (Mischler, 1991). Some researchers refer to this style of interviewing as more of a "guided conversation" (Rubin & Rubin, 1995). One interview per faculty participant of approximately one hour in duration was conducted with each of the four faculty medical educator participants.

In response to participants, open-ended questions were used as a probe to gather a wide range of perspectives. In-depth interviewing is designed to elicit a rich understanding of the participant's way of thinking. These interviews are less structured than a typical interview to allow for probing of topics that participants may raise. The semi-structured interview is the mode of choice when a researcher knows what he or she does not know and can therefore frame appropriate questions, while the conversational interview is used to elicit discussion about opinions or values that the participant deems relevant or meaningful to the topic. Such conversational questioning alerts a researcher to aspects of their topic that otherwise may be overlooked.

The interviews were audio taped and transcribed. In keeping with respectful research, participants had the opportunity to read the transcribed interviews for clarification and to sign a Data Transcript Release (Appendix C). The completed thesis with analysis of this data will be available to all study participants. Thus, the participants will have an opportunity to read what is said about their participation, but identifying information will be excluded.

Appendix A-5 presents a sample of some of the questions that initially guided the conversation. A pilot study was conducted in ERES 800.3 in November/December 2006 for practicing this mode of research inquiry. This was done both as a practice run for the questions and for training as an evaluator in qualitative research practices. This mini-study was completed successfully. The faculty participant involved in the practice session was not included in the current proposed study.

DATA ANALYSIS

The data collected was analyzed in accordance with established quantitative and qualitative research methodology. Table 3.1 presents the principal research questions and the research methodologies that were designed to provide answers to the same. It also demonstrates the multiplicity of research methodology, data collection, and subjects in this study (i.e., a triangulation of research methodology).

Table 3.1. Research methodologies link to specific research questions

Research Questions	Students' perceptions Survey questionnaire	Students' perceptions Focus-group interviews	Faculty perceptions Survey questionnaire	Faculty perceptions Interviews
RES Q 1	X	X	X	X
RES Q 2	X	X		
RES Q 3			X	X

Res Q 1: What are the advantages and disadvantages of the horizontal versus vertical integration?

Res Q2: What are the student perceptions with respect to their learning satisfaction, engagement, learning environment, and stress to horizontal and vertical integration of pathology teachings?.

Res Q 3: What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum, according to medical faculty participants in this study?

Quantitative Data

The global score of the student perceptions was analyzed and scored according to category. Further, inter-group comparative analysis between the first- and second-year medical students, first-year medical and dental students, inter-modular comparisons amongst first-year students, intersystem comparisons for second-year, and inter-modular comparisons amongst first-year medical and dental students were undertaken by one-way ANOVA. Though the response categories in the Likert scale have a rank order, the intervals between values cannot be presumed equal and therefore fall within the ordinal level of measurement (Blaike, 2003; Jamieson, 2004). The degree of consonance, both within and between the groups, was further subjected to Post Bonferroni tests where applicable.

Quantitative analysis of faculty perceptions to the semi-structured questionnaire was used as a guide for the detailed interview but not subjected to statistical analysis.

Qualitative Data

All data were analyzed once all interviews were completed to maintain a clear focus for each interview wherein they could be compared and contrasted while being categorized. Organizing, analyzing, and synthesizing the data was guided by the strategies of Bogdan and Biklen (2006), Mischler (1991), and Patton (2002), and involved working with the data, organizing, coding, synthesizing, and searching for patterns and common threads amongst the participants. The audiotapes were transcribed and coded by date. All information was read through to "get a sense of the whole" (Patton, 2002, p. 440). Categories of data were developed based on the research purpose and questions. Patton (2002) described the close look at the data as one of inductive analysis, with searching for themes, patterns and categories to emerge as the process of 'open coding" (p.453). Analysis was ongoing by sifting through the data looking for patterns and connections using a constant comparative methodology. Through analytic induction involving coding and grouping into categories as required and repeating this process a few times, one will be able to infer that events or statements were instances of the same underlying theme all the while keeping the research question in focus.

As a researcher, questions to be asked will include "Is this code similar to or different from other codes?" A similar technique was used in looking for patterns between the codes and categories by using my insights and knowledge of the subject area. Such intensive study of the summary of these patterns used in rendering the interpretation of this study may require me, the researcher to think in new, dialogical language. Interpretation involves redesigning old categories, formulating new relationships by combining elements in novel ways, projecting beyond what actually exits, and conjuring up probable connections. As the data sample was small (four interviewees) and as this data was just one portion of this research methodology this data was not subjected to analysis by computerized qualitative software aids such as Atlas or Nudist (Barry, 1988).

DATA DISSEMINATION

The findings of this study will be integrated with those of related and relevant studies (a) to establish how these results relate to broader theoretical frameworks, (b) to explicate what the study means outside this context, (c) to serve as an in-service monitoring form of evaluation/assessment

of the newly implemented curriculum, (d) to be aware of any major immediate errors or dissatisfactions, and (e) to make recommendations and suggestions regarding these observations to the Undergraduate Curriculum Committee of the College of Medicine at the University of Saskatchewan. The results of the analyzed data may be included in presentations at workshops, lectures, papers, or poster presentations to be shared with other medical educators at conferences and/or meetings either locally or at the regional, national, or international level as required. Written reports and publications may be generated for suitable journals based on this study's findings.

ETHICAL CONSIDERATIONS

This study was pursued following approval from the Behavioural Board of Ethics of the University of Saskatchewan Ethics Committee. There was no risk or deception used in this study. Participants were made aware of the purpose of the study and why they were participants. None of the survey or interview questions were observed to be of an uncomfortable nature. The study is classified to be one of minimal risk and was conducted after informed consent was obtained from all participants as per ethics approval. All data obtained will be held in confidence and will be de-identified for usage in data presentations. All data material obtained with respect to this study will be held in confidential storage at the University of Saskatchewan for five years after completion of the study. After that point, they will be destroyed in accordance with University regulations. A copy of the ethics proposal is attached in Appendix 3.5

CHAPTER 4
Data Presentation, Analysis, and Discussion

INTRODUCTION

This chapter will present the data collected from first-year medical and dental students, second-year medical students, and faculty medical educators who participated in the undergraduate curricular changes in the College of Medicine, University of Saskatchewan in Saskatoon from January 2006 to May 2007. The multiple data collections include quantitative and qualitative descriptions to evaluate perceptions and experiences of the program's learning environment. The collected data will be summarized, analyzed, and presented as results of the study with reflections and interpretations to answer this study's research questions. This will be presented in three sections: (a) the perceptions of the student participants; (b) the perceptions of the faculty/medical educators; and (c) an overall combined student and faculty view of these findings in relation to the three research questions, with the development of a post-research conceptual framework.

STUDENT PERCEPTIONS

The first-year medical and dental students completed the specifically designed research survey questionnaires twice (at the end of the midterm examination and at the end of the final examination) for the horizontally integrated PATH 201 course, and thrice for the vertically integrated ITDL 201.18 course after completion of Modules 7, 10, and 12.

The second-year medical students completed the survey questionnaires on three occasions that coincided with the end of the study of the gastrointestinal system, neurological system, and the final exams of this PATH 302 course. Student participants from both first- and second-years were also involved in focus group interviews.

Student Survey Questionnaires

All students were reminded in advance via individual emails regarding the day and time of the research survey, including on every occasion the voluntary nature of participation. The survey questionnaires were administered during designated class time and accompanied by either a pizza lunch or midmorning snack. Prior to the in-class administration, the research process was once again explained for clarification, transparency, and open discussion of any unresolved questions.

Quantitative data obtained from these surveys will be presented and discussed first, followed by a representation and discussion of the qualitative data.

Quantitative Analysis

The quantitative data obtained is presented and discussed for three courses:

1. the vertically integrated ITDL 206.18, for first-year medical and dental students;
2. the horizontally integrated PATH 201 for first-year medical and dental students; and
3. the horizontally integrated PATH 302 for second-year medical students.

First-Year Medical and Dental Students in the Vertically Integrated ITDL 206.18

As indicated, students in the vertically integrated ITDL 206.18 completed survey questionnaires at the end of Modules 7, 10, and 12. These modules were studied because they had relevant general pathological concepts explicitly vertically integrated within the module syllabus. Except for Module 5, which had a similar integration that served as the test run in November 2006, the remaining modules did not participate in such a purposefully explicit vertical integration. Eighty-eight students were registered in this class: 80 students completed the survey for Module 7; 57 students for Module 10; and 73 students for Module 12.

All data were entered into SPSS version 15.0 (Windows version) for analysis. The data from the 48-item questionnaire for all modules were compiled into one file and subjected to data reduction by principal component analysis (as described in the research design in Chapter 3). The reversed questions in this survey were rescored for the purpose of this analysis. Eleven factors (Factors 1-11) were computed with a reliability statistics of Cronbach's alpha of 0.841, and were considered suitable for further analysis. The 11 factors were labeled according to the most dominant theme associated with the item questions categorized within these individual factors. The reversed items scored uniformly low in all three data sets, translating to a "disagree" in keeping with the anticipated response. This supports the view that, despite repetitive data collection, there was no data corruption due to "student fatigue."

Table 4.1 summarizes the eleven factors with the means of the 142 medical and 68 dental students' responses accompanied by their F and P value. The statistical derivation of these factors with the item clustering further gives strength to the research design instrument (i.e., clustering of pre-design test question items). Appendix 4.1 provides further detailed information regarding the item questions that were used to compute these factors with the individual student responses in the various modules examined and their comparisons, which will be addressed later.

TABLE 4.1. Survey results of the first-year medical and dental student responses in the vertically integrated ITDL 206.18 for modules 7, 10 &12.

FACTORS 1 to 11 (Likert Scale 1 -5)	Overall Grand mean of all 210 student responses	142 Medical Students response Mean	68 Dental Students response Mean	Comparison of medical and dental students using one-way ANOVA analysis	
				F value	P value
Factor 1 Student Learning Satisfaction with Integration	3.57	3.71	3.33	12.35	**.001**
Factor 2 Learning with understanding and Vocational relevance and Integration	3.50	3.71	3.10	34.16	**.000**
Factor3 Analytical learning and Integration	3.60	3.78	3.25	28.42	**.000**
Factor 4 Learning Environment and Integration	3.80	3.95	3.51	25.28	**.000**
Factor 5 Student engagement and Integration	3.26	3.36	3.06	7.54	**.007**
Factor 6 Focus and clarity of goals and objectives in Integrative Environments	3.56	3.68	3.35	5.414	**.021**
Factor 7 Student Stress with Integration	2.96	2.95	2.99	.096	.757
Factor 8 Self directed student driven learning in Integrative environments	3.33	3.49	3.02	25.456	**.000**
Factor 9 Teacher feedback and integration	3.25	3.28	3.19	.593	.442
Factor 10 Multidisciplinary Interrelationships in Integration	3.66	3.67	3.63	.110	.741
Factor 11 Application-learner centered and Integration	3.50	3.53	3.43	.730	.394

With respect to vertical integration, the grand mean responses to student learning satisfaction with integration (3.6), learning with understanding and vocational relevance (3.5), analytical learning (3.6), the learning environment (3.8), student engagement (3.3), focus and clarity of goals and objectives (3.6), and multidisciplinary interrelationships (3.6) were agreeable (Scale: neutral (3), agree (4), strongly agree (5)). However, a notable difference was observed between medical and dental students' responses. For example, the grand mean of all student responses to the learning environment was 3.8, yet the medical students scored a 3.95 versus the dental students'

score of 3.51. On the other hand, student stress, which had an overall grand mean of 2.96, appeared to score no significant differences (2.95; 2.99) between the two student populations. On the whole, the dental student responses to this integration were less favorable in many of the analyzed factors. These statistically significant differences between the two student groups' perceptions will be discussed shortly. As per the research design in Chapter 3, the level of significance was set at $P<0.05$

First-Year Medical and Dental Students in the Horizontally Integrated PATH 201.3

Pathology 201.3 was a stand alone 16 hours, once per week, Term II (January to May) pathology course. This course addressed the concepts of General Pathology delivered to first year medical and dental students temporally and horizontally integrated with the remainder of the medical curriculum. The same 88 students who registered for ITDL 201.18 also participated during the same time frame in the completion of the specifically designed survey questionnaire for the horizontally integrated stand-alone general Pathology 201 course. Data were collected at the end of the midterm examination halfway through the course, and at the end of the course at the final examination. Of these 88 registered students, 85 participated in the survey questionnaire at the end of the midterm, and all 88 completed the survey questionnaire at the end of the final examination.

All data obtained from the 48-item questionnaires were entered into SPSS version 15.0 for analysis. A composite file of the two data entries was created and further reduced by statistical data extraction done by principal component analysis. The reversed questions in this survey were rescored for the purpose of this analysis. Nine factors (Factors 1-9) were computed with a reliability statistics of Cronbach's alpha of 0.848, and were considered suitable for further analysis. The nine factors were labeled according to the most dominant theme associated with the item questions categorized within these individual factors (similar to the previous data set). The computer-generated item clustering for the development of these factors matched, for the most part, the pre-design test question item clustering. The reversed items uniformly scored low in all three data sets, translating to a "disagree" in keeping with the anticipated response. This supports the view that despite repetitive data collection, student fatigue did not interfere with their responses at data collection.

Table 4.2 provides a summary of the factors with their means and P and F values, while Apendix 4.2 presents, in detail, the aggregated means of the two groups of medical and dental

student responses with their grand means to the survey questionnaire items as they cluster within their categories.

Table 4.2. Horizontally integrated first-year medical and dental students survey results with F and P value for the comparisons of the medical and dental students in PATH 201.3

FACTORS 1 to 9 (Likert Scale 1-5)	173 Overall Student responses Mean	117 Medical students response Mean	56 Dental students response Mean	Comparison of medical and dental students using one-way ANOVA analysis	
				F Value	P value
Factor 1 Student Learning satisfaction	3.71	3.91	3.29	30.19	**.000**
Factor 2 Analytical Learning	3.50	3.61	3.25	11.56	**.001**
Factor 3 Focus and Clarity of goals and objectives	3.70	3.84	3.40	10.93	**.001**
Factor 4 Student engagement	3.54	3.65	3.30	8.82	**.003**
Factor 5 Learning environment	3.99	4.20	3.53	21.82	**.000**
Factor 6 Student Stress	3.15	3.29	2.87	7.10	**.008**
Factor 7 Self-Directed Learning /Academic self perception	3.45	3.61	3.12	22.75	**.000**
Factor 8 Student interactions	3.79	3.94	3.47	18.30	**.000**
Factor 9 Deep Learning (Learning with understanding vs.rote memorization)	3.06	3.07	3.05	.01	.934

Once again, predominantly agreeable responses were provided to items concerning overall student satisfaction of learning, analytical learning, focus and clarity of goals and objectives, learning environment, student engagement, and deep learning to this horizontally integrated course. A positive learning environment, with an overall grand mean of all student responses of 4 (agree), was observed, similar to the responses in ITDL 206.18. However, as observed previously, the trend of statistically significant differences continued to be observed between perceptions of the medical and dental students. As per the research design in Chapter 3, the levels of significance were set at $P<0.05$.

As listed in Table 4.2, the factors were composed of the questionnaire items that scored positively, with most items related to student learning satisfaction receiving “agree” (4) responses,

and a grand mean score of 3.7 to this horizontal integration of pathology teachings. Positive learning environment recorded a grand mean of 4. Student stress was low, with a grand mean of 3 and an agreeable student engagement score of 3.5. Except for the domain of deep learning, all factors computed were significantly different between the medical and dental students' perceptions. This will be discussed in greater detail in a later section.

Analysis of the individual item questions, as presented in Appendix 4.2, supported the factor analysis item clustering. Q48 related to student learning satisfaction to the horizontal integration of pathology teachings, and had an aggregated mean score of 3.8. Similarly, a positive agreeable learning environment was recorded with an aggregated mean of 4.2 on Q15 and 4.3 on Q37. Student stress found more disagreement, with an aggregated mean of 2.7 on Q16. Student engagement score on Q19 was agreeable, with an aggregated mean of 3.7. Except for the domain of deep learning, all computed factors were significantly different between medical and dental students' perceptions. This will be discussed further in a later section.

Second-Year Medical Students in the Horizontally Integrated PATH 302.9

Sixty-one (61) second-year medical students were registered in this course. These students completed the survey questionnaire on three occasions, coinciding with the end of the respective clinical system being addressed in the undergraduate medical curriculum. The first survey, which was administered at the end of the gastrointestinal (GI) systems, had 42 participants, while the second survey, at the end of neurology (Neuro) systems, had 54 participants. The final survey, at the end of the final examination (Final), had 60 participants.

All data obtained from the 49 itemed questionnaires completed at the end of the three systems, including the final examinations, were entered into SPSS version 15.0 for analysis. A composite file of the three data entries was created and reduced by principal component analysis. Twelve factors (Factors 1-12) were computed with a reliability statistics of Cronbach's alpha of 0.861, and were considered suitable for further analysis. The twelve factors were labeled according to the most dominant theme associated with the item questions categorized within these individual factors.

Table 4.3 details the twelve factors with the individual means of the medical student responses in each system and their overall composite grand means (GI+Neuro+Final). Table 4.3

also lists the P and F value of the intersystem comparisons (GI vs. Neuro vs. Finals) by one-way ANOVA analysis.

Table 4.3. Survey results for second-year medical students in horizontally integrated PATH 302.9

Factors 1 to 12 (Likert Scale 1-5)	**GI Mean**	**Neuro Mean**	**Final Mean**	**Overall Mean GI+Neuro +Final**	**Intersystem comparisons by one-way Anova analysis (GI *vs* Neuro *vs* Final)**	
					F Value	**P Value**
Factor 1 Student satisfaction	3.70	3.48	3.98	3.70	6.47	**.002**
Factor 2 Student engagement	3.57	3.48	3.89	3.66	5.85	**.004**
Factor 3 Learning environment	3.94	4.22	4.37	4.20	7.00	**.001**
Factor 4 Inter related learning	4.02	3.81	4.16	4.00	3.98	**.021**
Factor 5 Student's self learning	3.84	3.76	4.04	3.89	3.57	**.030**
Factor 6 Self Directed Learning	3.12	3.17	3.41	3.25	2.09	.127
Factor 7 Student Stress Load	3.07	3.03	3.17	3.09	.358	.693
Factor 8 Analytic Learning	3.43	3.20	3.40	3.34	2.52	.084
Factor 9 Contact Teaching	3.50	3.46	3.60	3.53	.37	.69
Factor 10 Focus, Clarity, Goals	3.60	3.51	3.89	3.68	4.77	**.010**
Factor 11 Temporal alignment	3.82	3.77	3.84	3.81	.089	. 915
Factor 12 Learning with understanding	3.69	3.75	3.91	3.80	1.55	.216

The negative questions in this survey were rescored in the reverse for the purpose of this analysis. Overall, the grand means of student satisfaction (3.7), student engagement (3.7), learning environment (4.2), interrelated learning (4.0), student self-learning (3.9), focus with clarity of goals and objectives (3.7), temporal alignment (3.8), and learning with understanding (3.8) were agreeable and positive. Student stress—an overall grand composite mean of 3.1—was the lowest overall score in this set of data. Some differences were observed in the analytical comparison of the

student perceptions means, both between and within the individual systems, and this will be explored in detail in a later section.

Appendix 4.3 summarizes the grand mean and individual means of student responses in each of the systems (GI, Neuro, Finals) for each itemized response to the questions within each of the twelve factors. Student responses to the learning satisfaction of this horizontally integrated curriculum in the second year were uniformly positive and agreeable, with a grand mean of 3.9 for Q8 and Q49. The overall student response to the learning environment was positive and agreeable, with the aggregated means ranging from 4.3 for Q15 and 4.1 for Q37 and Q38. Student interaction had an aggregated mean of 4.3 for Q43, which was agreeable and positive, as was relevance to future training, which had an aggregated mean of 4.01 for Q48. Students did not perceive a shift in the teaching of this course from being content-centred to learning-centred (a mean of 2.52 for Q17). Student stress was neutral and disagreeable, with a mean of 3.0 for Q16. Learning with understanding in relation to clear goals and objectives received a favoured scoring, with an aggregated mean of 2.5 for Q28 (a reversed item) and a mean of 4.19 for Q13.

Comparison of Student Perceptions

Various subset combinations of this primary data further analyzed student perceptions to answer directly this study's research questions. Analysis of the first- and second-year medical students was conducted in order to look for similarities and differences that may be attributed directly to maturity, awareness, and familiarity of the integration process in a matched horizontally integrated pathology course.

First-year medical versus second-year medical students in horizontal integrated teaching of pathology (final exam PATH 201 vs. final exam PATH 302).

Data collated from the 59 first-year medical students who participated in the survey questionnaire at the end of the final examination in PATH 201 were compared to the data collated from the 60 second-year medical students who completed the survey questionnaire at the end of the final examination in PATH 302. These sets of data were chosen for comparison because they shared the following commonalities:

1. free-standing independent pathology courses;

2. end-of-course evaluations, thereby providing a holistic perception of the entire course; and
3. the representation of student perceptions on the process of horizontal integration.

In order to maintain comparable question items for the purposes of analytical comparison, the following modifications were made to the data set:

1. Question #45 in PATH 302 and PATH 201 referred to the interrelationships of various disciplines dissimilar to the two groups, and was therefore deleted from both data sets;
2. Question #47, referring to last year's work providing a continuum, was deleted from the Final Exam PATH 302 data set because there was no comparable data for the first-year medical students; and
3. Questions #48 and #49 of PATH 302 were therefore recoded as Questions #47 and #48 to create a matching student survey of 48 items.

The composite data were further reduced by a factor analysis by principal component analysis, resulting in twelve factors (Factors 1-12) with a Cronbach's reliability alpha score of 0.821. These data were considered suitable for further analysis. The twelve factors were labeled according to the most dominant theme associated with the item questions categorized within these individual factors. The reversed question items in this survey were rescored for analytical purposes. Table 4.4 summarizes the twelve factors with a respective overall grand means for all students and individual means of the first-year and second-year responses, with f and p values generated by one-way ANOVA analysis.

Significant differences at $P<0.05$ were observed with respect to the domains of student engagement with active independent learning with understanding (factor 4 means of 3.59 and means of 3.84) for the first- and second-year medical students, respectively ($p=0.04$). A similar trend was observed with student perceptions to stress (means of 2.53 and 3.17) for the first- and second-year medical students, respectively ($p<0.001$). The two groups of student responses comparisons were not statistically significant in the remainder of the factors, as shown in Table 4.4.

Table 4.4.Survey results for first-year versus second-year medical students in the horizontally integrated courses, final exam PATH 302 versus final exam PATH 201

Factors 1-12 (Likert Scale 1-5)	119 Overall student responses Mean	59 First year student responses Mean	60 Second year student responses Mean	One-way ANOVA comparisons between first and second year student responses F Value	P value
Factor 1 Student learning satisfaction	3.87	3.91	3.84	.502	.480
Factor 2 Analytical learning and relevance	3.99	4.02	3.97	.174	.677
Factor 3 Learning environment	4.12	4.17	4.06	1.037	.311
Factor 4 Student engagement, Active learning	3.71	3.59	3.84	4.127	**.044**
Factor 5 Student self learning	3.83	3.78	3.88	.955	.330
Factor 6 Course structure and learning	3.68	3.67	3.69	.010	.921
Factor 7 Student stress	2.86	2.53	3.17	15.163	**.000**
Factor 8 Focus, goals and objectives	4.22	4.15	4.29	1.602	.208
Factor 9 Self independent learning	3.39	3.41	3.38	.054	.817
Factor 10 Student independent study	3.82	3.82	3.82	.001	.982
Factor 11 Knowledge creation	3.62	3.54	3.70	2.130	.147
Factor 12 Evidence based medicine	3.84	3.89	3.79	.783	.378

These observed differences might perhaps be directly related to the level of maturity of the students coupled with receptiveness, awareness, and familiarity of the integration process between the two groups. It is interesting to observe that while the second-year students felt more engaged in their learning (mean 3.8) in comparison to the first-years (mean 3.6), their perceptions of stress were also higher, with a mean of 3.2 compared to the first-years' mean of 2.5. This might be related to other curricular demands, such as increasing clinical work, or other concomitant course-related workload.

Appendix 4.4 provides further detail regarding the item questions that computed these factors. The item clustering of questions that compose these factors further validates the design of the survey questionnaire.

First-year medical students versus first-year dental students.

As the first-year students formed a mixed group of medical (n=60) and dental students (n=28) with different end-career goals, student perceptions of this ongoing process of integration were compared between and within the two populations of students. In this context, the composite factor data files (Modules 7, 10, and 12) generated for the vertically integrated ITDL course and the composite (midterm and final exams) for the horizontally integrated PATH 201 course were utilized for this analysis, as displayed previously in Table 4. 1 and Appendix 4.1 for the ITDL course and Tables 4.2 and Appendix 4.2 for the Pathology 201 course, respectively.

Vertically integrated ITDL 206

The collated Module 7, 10, and 12 survey questionnaire responses had 142 (67.6%) medical student respondents versus 68 (32.4%) dental students' respondents. The means between and within the two groups were compared by a one-way ANOVA. Post hoc tests were not performed for this analysis because there were fewer than three groups.

Based on this multidisciplinary integration process, many dissimilarities were noted between the two student populations in relation to student learning satisfaction (means of 3.71 and 3.33 for medical and dental students, respectively, with a p value of 0.001); student perceptions on learning with understanding and vocational relevance and integration (means of 3.71 and 3.10, with a $p<.001$); analytical learning (means of 3.78 and 3.25, with a $p<0.001$); learning environment (mean of 3.95 and 3.51, with a $p<0.001$); student engagement (means of 3.36 and 3.06, with a p value of 0.007); focus and clarity of goals and objectives (means 3.68 and 3.35, with a p value of 0.021); and self-directed learning activities (means 3.49 and 3.02, with a $p<0.001$). The main theme linking these disparities seems to be related to the lack of academic and vocational relevance of this course to the dental students in this composite group. There was no difference within the groups of individual student populations thereby representing a holistic consistent voice for each student population. Student stress was not significantly different between the two groups, which seems plausible given that they were both exposed to similar stressors with respect to their courses in their first year. Similarly, their perceptions of teacher feedback and reception to a learner-centered

approach of teaching and learning were statistically similar. Thus, this data suggests that it may be that the current integration process, which is predominantly designed for the undergraduate medical curriculum, does not align with the long-term goals and objectives of dental students. In this context, it is important to reevaluate teaching methods and the classroom environment to correct this apparent disconnect within the inter-professional student body.

A consistent similar relationship was observed in the perceptions of the same students in the horizontally integrated PATH 201 (as demonstrated in Tables 4.2 and Appendix 4.2). Thus, differences between the medical and dental student groups' perceptions were persistent and consistent in both the vertical and horizontal integration environments.

Horizontally integrated PATH 201

The total collated midterm and final examination survey questionnaire responses was 117 (67.2%) medical student responses and 56 (32.8%) dental student responses in a class composed of 60 medical students and 28 dental students. The factored data were compared by a one-way ANOVA, as previously indicated. As there were fewer than three groups, post hoc tests were not performed for this analysis.

Once again, as observed in the vertically integrated ITDL course, except for student stress and learning with understanding versus rote memorization, there were statistically significant differences between the perceptions of the medical and dental student populations regarding student learning satisfaction (means 3.91 and 3.29, with a $p<0.001$); analytic learning (means 3.61 and 3.25, with a p value of 0.001); focus and clarity of goals and objectives (means 3.84 and 3.40, with a p value of 0.001); student engagement (means 3.65 and 3.30, with a p value of 0.003); learning environment (means 4.20 and 3.53, with a $p<0.001$); self-directed learning activities (means 3.61 and 3.12, with a $p<0.001$); and student interactions (means 3.94 and 3.47, with a $p<0.001$) as detailed in Table 4.2 and Appendix 4.2.

Surprisingly, significant differences were also noted between the two groups of students in the domain of student stress perceptions (means 3.29 and 2.87, with a p value of 0.008). This may be attributed to the Term II course-intensive curriculum structure for dental students, which differ in Term II afternoons compared to afternoon self-study periods for medical students. Perhaps this contributed additional stress for self-directed learning activities and preparation for the horizontally integrated PATH 201 class that was based more on a learner-centered than teacher-centered

approach. Evidence of a lack of academic and vocational relevance persisted in this particular data analysis. There was no difference within the groups of individual student populations, whose perceptions were consistent, global, and evenly distributed, as seen in the vertically integrated environments of ITDL 206.18. This data analysis also supports the recognition that the current integration process, which is predominantly designed for the undergraduate medical curriculum, does not align with the long-term goals and objectives of dental students. The data also supports the view that a persistent disconnect within the inter-professional composite first-year student populations of medical and dental students occurs in both the horizontal and the vertical modes of curricular integration environments.

Vertical integration versus horizontal integration.

In order to answer the second research question—What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum?—through the lens of students perceptions, the item questionnaire data of the horizontally integrated PATH 201 midterm was compared to the item questionnaire data of ITDL Module 7 in the vertically integrated course. These two sets of data were chosen because they: (a) were responses from an identical cohort of first-year medical and dental students, and (b) represented an evaluation at a similar timeframe in the delivery of the curricular integration process.

Data were collated from 80 first-year students' responses (medical and dental) in the ITDL Module 7, and 85 first-year student responses (medical and dental) at the PATH 201 midterm exam. In order to maintain comparability, the responses to Questions #22 and #23 on the ITDL module were numbered in reverse to match the item content of the PATH 201 survey questionnaire. The composite data were subjected to data reduction by factor analysis. Ten factors were computed with a Cronbach's reliability of 0.94, and were considered suitable for further analysis. The factors were labeled according to their most dominant common theme. Table 4.5 summarizes the ten factors, with their overall grand means and respective means of the student responses to the horizontal and vertical integrative environments. The reversed items in this survey were rescored for analytical purpose. The means of the vertically and horizontally integrated student responses were compared by a one-way ANOVA analysis. As there were fewer than three groups, post hoc tests were not performed for this analysis.

TABLE 4.5. Student perceptions on vertical (ITDL-Module 7) versus horizontal integration (PATH 201 midterm) with one-way ANOVA comparison analysis

Factors 1 to 10 (Likert Scale 1-5)	Vertical Integration Mean of 80 student responses	Horizontal Integration Mean of 85 student responses	Grand Mean of 165 student responses	ANOVA Comparison of Perceptions between the vertical and horizontal integration
FACTOR 1 Student learning satisfaction	3.49	3.60	3.54	0.313
FACTOR 2 Analytical learning	3.69	3.60	3.64	0.384
FACTOR 3 Focus clarity integration	3.42	3.51	3.47	0.400
FACTOR 4 Student Stress	2.81	3.04	2.93	0.077
FACTOR 5 Student Independence Learning	3.13	3.27	3.20	0.233
FACTOR 6 Student Reflection and Interaction	3.34	3.81	3.58	**0.000**
FACTOR 7 Student Engagement	3.05	3.62	3.34	**0.000**
FACTOR 8 Goals, Objectives and Knowledge	3.71	3.90	3.81	0.104
FACTOR 9 Student learning environment	3.84	4.09	3.97	0.371
FACTOR 10 Vocational relevance	3.42	3.61	3.52	0.247

It is interesting to observe that significant differences were related to student engagement (means 3.05 and 3.62, with a $p<0.001$) between the vertical and horizontal, respectively, and to student reflection and interaction (means 3.54 and 3.81, with a $p<0.001$). The remaining factors were not statistically different both within and between the groups.

These data may support the view that both forms of curricular integration complement each other, and perhaps the differences observed in these two domains are attributable to the differences in instructional strategies used in one course by medical educators who favored an increased component of student engagement and promoted student interaction and reflection.

Appendix 4.5 provides further details regarding the survey item questions that computed these factors, and this item clustering further validates the design of the theme-based research survey questionnaire.

Intermodular comparisons amongst first-year students (medical and dental) in the vertically integrated ITDL course.

As proposed in the research questions, inter-modular comparisons within the vertical integration process were also analyzed to evaluate whether any other factors besides the integration process may have contributed to the observed differences in the overall student perceptions. Data gathered from the survey questionnaires of the first-year medical and dental students in the vertically integrated ITDL 206.18 were subjected to data reduction by principal component analysis. Eleven factors were computed with a Cronbach's reliability of 0.84. These data were subjected to further analysis both within and between Module 7 GI (Gastrointestinal), Module 10 Imm (Immunology), and Module 12 IS (Interacting Systems) by a one-way ANOVA analysis.

Table 4.6 details the means of the factored student perceptions for the modules in this course. Once again, with respect to vertical integration the overall grand means for responses concerning student learning satisfaction with integration (3.57); learning with understanding and vocational relevance (3.5); analytical learning (3.6); the learning environment (3.81); student engagement (3.26); focus and clarity of goals and objectives (3.56); and multidisciplinary interrelationships (3.66) were identical. The only factors that were statistically significant between the three modules was student engagement and integration. The means were 3.05 for the GI Module 7, 3.35 for the Immunology Module 10, and 3.42 for the Interacting System Module 12.

As there were three groups for analysis, post hoc Bon Ferroni comparisons were conducted at a significance level of $p \leq 0.05$. Factor 5, representing student engagement and interaction, was statistically significant at $p=0.004$ between the three modules. Inter-modular analysis revealed that Module 7 was significant to Module 10 at $p=0.047$ and to Module 12 at $p=0.005$. Such inter-modular significances may be related to: (a) a variety of online quizzes and projects used in Module 10; and (b) Module 12 being an overall review module requiring an experiential project occurring close to the exam period, thereby increasing student stress, and so it was judged differently in comparison to the relaxed student engagement activities in the initial Module 7.

Table 4.6. Intermodular comparisons for Module 7 GI (7), Module 10 Imm (10), and Module 12 IS (12) amongst first year students (medical and dental) in the vertically integrated ITDL 206.18 course

Factors 1 to 11 (Likert Scale 1-5)	GI {7} Mean	Imm {10} Mean	IS {12} Mean	Overall Grand Mean GI {7} + Imm{10} + IS {12}	Intermodular comparisons between GI *vs.* Imm *vs.* IS by one-way ANOVA analysis F Value	P value
Factor 1 Student Learning Satisfaction with Integration	3.56	3.63	3.49	3.57	.52	.594
Factor 2 Learning with understanding and Vocational Relevance and Integration	3.44	3.52	3.55	3.50	.53	.585
Factor 3 Analytical learning and Integration	3.66	3.49	3.64	3.61	1.11	.331
Factor 4 Learning Environment and Integration	3.82	3.77	3.82	3.81	.14	.869
Factor 5 Student engagement and Integration	3.05	3.35	3.42	3.26	5.67	**.004**
Factor 6 Focus, and clarity of goals and objectives in Integrative Environments	3.52	3.68	3.50	3.56	.74	.478
Factor 7 Student Stress Load with Integration	2.81	3.11	3.02	2.96	2.81	.062
Factor 8 Self directed student driven learning in Integrative Environments	3.26	3.31	3.43	3.33	1.43	.242
Factor 9 Teacher feedback and Integration	3.27	3.23	3.25	3.25	.04	.956
Factor 10 Multidisciplinary Interrelationships in Integration	3.58	3.75	3.68	3.66	.81	.447
Factor 11 Application-learner centered and integration	3.50	3.34	3.63	3.50	2.02	.135

Intersystem comparisons amongst second-year medical students in the horizontally integrated PATH 302 course.

Data gathered from the survey questionnaires amongst the second-year medical students were analyzed both within and between the three systems (gastrointestinal (GI), neurology (Neuro), and Final) were subjected to a similar pattern of analysis as detailed earlier in Table 4.3 and Appendix 4.3. A one-way ANOVA analysis was used to compare the means between the groups.

As there were three groups, a post hoc Bon Ferroni comparison was also done between and within groups, with a significance level set at $p \leq 0.05$.

Table 4.7. Intersystem post hoc (Bonferroni) multiple comparisons for second-year students, PATH 302

Factors of Significance	GI Mean to Neuro Mean	GI Mean to Final Mean	Neuro Mean to Final Mean
Factor1	(3.7; 3.48)	(3.7; 3.98)	**(3.48; 3.98)**
P value	0.236	0.356	**0.001**
Factor 2	(3.57; 3.48)	(3.57; 3.89)	**(3.48; 3.89)**
P value	1.00	0.062	**0.004**
Factor 3	(3.94; 4.22)	**(3.94; 4.37)**	(4.22; 4.37)
P value	0.061	**0.001**	0.459
Factor 4	(4.02; 3.81)	(4.02; 4.16)	**(3.81; 4.16)**
P value	0.387	0.867	**0.017**
Factor 5	(3.84; 3.76)	(3.84; 4.04)	**(3.76; 4.04)**
P value	1.000	0.259	**0.031**
Factor 10	(3.60; 3.51)	(3.60; 3.89)	**(3.51; 3.89)**
P value	1.000	0.110	**0.011**

Six factors—Factor 1 (student learning satisfaction) at p=0.002; Factor 2 (student engagement) at p=0.004; Factor 3 (learning environment) at p=0.001; Factor 4 (inter-related learning) at p= 0.021; Factor 5 (students' self learning) at p=0.03; and Factor 10 (focus and clarity of goals and objectives) at p=0.01—were statistically significant, as indicated in Table 4.3. These represent differences observed between the three points of evaluation at the end of the individual systems in the horizontally integrated Pathology 302 course for the second-year medical students.

The post hoc Bon Ferroni multiple comparisons tests between the three systems are summarized in Table 4.7, which shows that there is no statistically significant differences between the GI and the Neuro module data. On the other hand, many factors are significantly different in the Neuro and Final data sets. Factor 3 is also significant in the GI and Final data sets. The common data set that appears to cause a statistically significant difference relates to the mean from the data sampling at the finals, as highlighted in Table 4.7. In this context, the Final mean data represented a combined sampling at the end of the relevant system and the entire course. This may, in part, be an explanation for the observed differences. Further, the teachings in each of these systems were

administered by different professors with varied teaching styles, which might also account for the observed different student perceptions between the three systems. However, as multiple factors are probably responsible for the observed differences, further research abd in-depth analysis will need to be undertaken, controlling for more variables to explain exactly the differences and anomalies observed.

e) Student Content assessment Outcomes

Assessment outcomes of the students' performance, as reflected by final grades for each of these courses, are listed below.

ITDL 206 - First-year medical and dental —Vertical integration

Class average	High	Low
84	93	72

PATH 201 - First-year medical and dental—Horizontal integration

Class average	High	Low
83	93	70

PATH 302 - Second-year medicals —Horizontal integration

Class average	High	Low
78	92	64

The above data confirms that the final grade assessment results in all three courses were comparable, with no apparent differences between the course class averages, high, or lows in the first-year horizontal and vertically integrated courses, nor between the first- and second-year horizontally integrated courses. This supports the view that despite explicit changes in curriculum with both horizontal and vertical curricular integration, student learning as measured by the assessment utilized showed no apparent change. Thus, the integrative processes are perhaps just complementary processes and have not had any impact on the final assessment

Qualitative Analysis

Besides the structured response to the itemed questions, the student survey questionnaire also encouraged students to provide written comments to the following four questions:

1. What aspects of this COURSE have facilitated your learning with understanding?
2. What aspects of this COURSE did you like the most?

3. What aspects of this COURSE should be altered in the future?

4. Any other comments or suggestions?

Comments by the students will be presented for each three-course dataset.

Open-Ended Responses for ITDL (Vertically Integrated First-Year Course)

The responses related to the four open-ended questions in the survey questionnaire are summarized in Table 4.8.

Table 4.8. Summary of the open-ended comments in the survey questionnaire for the vertically integrated ITDL course

Modules	Q1 Facilitated learning	Q2 LIKE	Q3 Altered	Q4 Suggestions
Module 7	Dependent on teaching Relevance + Textbooks Goals + objectives	Relevance Interaction Interelationships Integration Teaching styles	Time usage Content overload Notes	Both horizontal + vertical integration Focus the exam assessment
Module 10	Active learning Teaching strategies Relevance	Text book relevance	Assignments Time allocation Marks/assessment	Time allocation to discipline Combined horizontal and vertical integration
Module 12	Relevance Teaching styles	Clinical relevance Interdisciplinary relevance	More integrated cases Better course organization structure	Time – needs to readjust

Comments pertaining to the question of what they liked and what facilitated their learning with understanding related to: (a) the relevance of the interrelationships of various disciplines, (b) including the pathology and laboratory content, (c) the structural course organization, (d) including a choice of textbooks, and (e) valuing goals and learning objectives. Other comments in this category were devoted to teaching styles and the various active teaching and learning strategies in the modules that promoted increased student engagement and other interactions. Yet, this has to be introduced cautiously, as one comment stated, “People need more time adjusting to this style of education. The method was really new to me and the information was overloading.” Another comment put it thus: “Integration should not be done so forcefully.” The clinical, interdisciplinary, and exam relevance of what was being taught and learned was appreciated.

The comments concerning future improvement included effectiveness of time allocation and content overload management. Further, true inter-multidisciplinary teaching was welcomed with both horizontal and vertical alignments throughout the curriculum. Finally, students recommended

revisiting the assessment component of these modules, but with a more concentrated effort to align them to the prescribed goals and objectives in each module unit.

Open-Ended Responses for PATH 201 (Horizontally Integrated First-Year Survey)

Many of the comments to the open-ended questions in the survey were similar to the feedback recorded in the concurrent vertically integrated ITDL 206.18, which is summarized in Table 4.9. Again, comments were written during both the midterm exam and the final examination surveys were typed and then categorized in the context of the four questions asked and listed below.

Table 4.9. Summary of the open-ended comments in the survey questionnaire for the horizontally integrated PATH 201

PATH 201.2	**Facilitated Learning**	**Like**	**Altered**	**Suggestions**
Midterm Exam	Dependent on teaching strategies Relevance Student engagement with active participation Appropriate textbooks Relevant exams	Relevance Interaction Inter-relationships Integration Teaching styles	Time usage Content overload Notes Format of integration—power struggles?	Both horizontal + vertical integration Focus the exam assessment to goals and objectives More time for this course
Final Exam	Goals + objectives and exams oriented Active learning Teaching strategies Relevance Inter-relationships with Vertical ITDL components	Integration with clinical relevance Slides and Power Point reorganization	Altered lectures with notes postings Content review and reorganization Assignments Time allocation	Too early to tell regarding effects of integration Time usage Combined horizontal and vertical integration

In this stand-alone pathology course, more positive feedback was given than for the ITDL survey questionnaires on course organization, prescribed textbooks, the exams and course assessment tools, the horizontal integration with the modules, and the clinical and academic relevance of this course. Negative comments and suggested improvements for the future focused attention to: (a) time management; and (b) content management with altered reviewed content reorganization in alignment to the integrative process, both vertically and horizontally. Suggestions included increasing contact time for this course with specific attention to the alignment of goals and course objectives to assessment tools. One interesting comment highlighted the limitation of this

focused study: “Perhaps ask us all in a few years if this course helped us integrate the knowledge gained in first year. When we have a better understanding of the pathological processes in the body we may better understand if this integration was successful or not.”

Open-Ended Responses for PATH 302 .9

For the older, more mature second-year medical students, a variety of teaching styles, including case-based and small group teaching, were incorporated, which perhaps aided and facilitated their learning with understanding. The focus and clarity of goals and objectives in the context of the various systems also helped in this regard. Universally, all students appreciated the temporal alignment of the pathology to the systems teaching protocol, and wished to encourage even tighter connections and alignments to: (a) the systems, (b) the structural schedules, (c) the goals, and (d) the assessment examinations. The different styles of each medical faculty member was valued, though students felt among themselves that “[d]ifferent prof’s [*sic*] have different expectations,” thus representing a misalignment of student versus instructor expectations. Table 4.10 summarizes the written responses to the four open-ended questions in the survey administered at three different points.

Table 4.10. Summary of the open-ended comments in the survey questionnaire for second-year medical students attending PATH 302.6

Systems	Facilitated learning	Like	Altered	Suggestions
GI	Dependent on teaching Relevance Follows the textbook Goals + objectives	Integration with systems Relevance Integration Teaching styles	Time usage Content overload Better notes	Avoid informational overload Independent study too early—not utilized Communication between the Integrators
Neuro	Active learning Teaching strategies Relevance	Text book Relevance	Competition versus integration Universal student engagement not focal	Time allocation to discipline Clear expectations More alignment with systems, schedules, goals, and exams
Final	Relevance Teaching styles	Vocational relevance Consistency Interactive	Better course organization structure Better communications with the systems coordinator Perhaps an extra systems class	Pathology is not the focus Different profs have different expectations Loss of identity of pathology Time—needs to readjust

One comment that supported strategies of facilitated learning mentioned "teaching of a disorder through interesting real life stories," which enhanced the clinical and academic relevance of the material addressed. This, complemented by the relaxed friendly classroom atmosphere, created a fun learning environment that contributed to a facilitated positive learning environment.

Two interesting themes emerged from the students written comments relating to:

1. loss of pathology identity with integration, as evidenced by the following comment: "I feel this course is an extension of systems; the title should be changed, as pathology is not the focus; it really is an extra systems class with an increased focus on oncology"; and
2. competition in integration, as noted in this response: "relating it to systems is important, but it should not be in direct competition."

These student observations suggest that it would be prudent to strike a delicate harmonious balance with curricula in the integrative process to ensure that there is no "perceived" or "true loss of identity" of the discipline being integrated. Further, in the process of integration, care should be taken to make sure that specific individual discipline blocks of teaching do not masquerade as fragmented versions of the curricular integrative processes.

Focus Group Interviews

As discussed in the methodology section of Chapter 3, qualitative data from the student were also obtained by focus group interviews, conducted by Dr. Marcel D'Eon in the office of Educational Support and Development. The summarized student comments were provided to the researcher in an electronic form. The complete report is listed in Appendices 4.6 (First-Years), 4.7 (Second-Years), and 4.8(Second-Years).

First-Year medical and dental students

A single focus group interview was held with the combined first-year medical and dental students on 11 April 2007 from 12:30 pm to 1:20 pm. The lead questions asked were:

1. What is integration?
2. What integration did you notice in pathology teaching?
3. How is integration helpful to your learning and lastly?
4. Suggestions for better integration?

In response to the first question, students seemed to acknowledge that integration meant collaboration between specialties and their faculty to create connections and new perspectives, leading to less "wasted time in repetitions." Being first-year students, they were unsure of vertical integration, as demonstrated in the response "Vertical don't know." As an introduction to some vertical integration, they appreciated the pathology and laboratory teaching components, and seemed to understand and appreciate the links and interrelationships to other disciplines. They felt that such integration helped their learning by: (a) reinforcement ("reinforces other aspects from other courses"), (b) timeliness of content continuum moving from normal to abnormal pathology ("getting the same thing at the same time so disciplines reinforce each other—physio reinforces anatomy etc"), (c) making connections, and (d) effective time management without repetitions. They recommended adding such pathology concepts at the end of every module and to continue with more effective communications between the normal histology to the abnormal pathology ("show the patho-histology connection"). They also suggested adding pathological material at the end of every module. They felt that the teaching of simple pathological concepts could be started earlier in the year and may be incorporated in other settings such as case-based and small group learning activities. They suggested better content and time management, as shown by the comment, "spread out the topics with cancer once a week … there's time to let it sink in, rather than getting it all at once and then never revisiting till second-year". Evaluation of the content both separately and within an integrated setting was recommended.

Second-year medical students

Two focus group interviews were held with the second-year medical students on 4 April 2007 and 2 May 2007. Their summarized data is reproduced in Appendix 4.7 and Appendix 4.8. As for the first-years, the same four questions were used to lead the focus group discussion.

Most second-year students understood integration to mean both faculty integration and content integration in order to achieve a continuum of theme-related complementary systems teaching. This, they felt, provided a "different broader perspective," with less repetition to the subject matter at hand. They felt that the integration process had gone well with this "systems, micro and path," providing an overall global perspective of the pathological disease process. They did, however, notice a disconnect and lack of integration amongst faculty members in some system

components. The students felt involved and engaged in their learning process. Integration, they believed, “reinforces, answers different questions, complements learning in other subjects in different ways.” They also seemed to relate to the content with greater enthusiasm due to it being clinically and vocationally relevant. Their comments included statements such as: integration “helps me to understand and not just memorize”; and “I understand better otherwise these are just words to memorize that I forget after the exam; when integrated I see where they fit in and understand the whole thing.” Thus, integration encourages deeper, long lasting learning, rather than surface bulimic learning, as evidenced by comments like “memorization is bad.”

Suggestions for improvement included: (a) greater communications between the disciplines with a clearer hierarchy of important and rare topics of interest, resulting in better and effective organization; and (b) effective time utilization in this integrated curriculum. It was suggested that pathology reports should be utilized to “make it more practical.” It was also recommended that pharmacology be integrated in order to provide a complete holistic study of the problem. Suggested improvements included continued attempts towards faculty integration together with content integration. Being second-year students, they also recognized some of the continuum chain links created for integration in their first-year pathology curricular design.

Thus, in summary, student perceptions (as recipients to the implementation) were summarized by favorable comments towards their exposure to both vertical and horizontal integrative environments. Both learning environments were perceived as being complementary and both were perceived to contribute and facilitate to their overall learning. The multidisciplinary integration of pathology and laboratory teachings in the vertical integrative environment enhanced the students’ ability to understand and diagnose the pathological basis of the disease process. Both improved quality of the learning experience and learning environment were positive outcomes from this educational intervention. Comparative analysis of the perceptions of medical students in years one and two to the horizontal integrative process showed similar experiences in most domains of learning. However, differences were present between the perceptions of student stress load and student engagement with active independent learning. These have been attributed to the students’ level of awareness, familiarity, and maturity going from their first year to their second.

Comparison of first-year medical and dental students’ experiences in both the vertical and horizontal integrative environments showed significant differences between the two student groups in many domains of learning, and can be attributed mainly to lack of alignment of this

predominantly medical oriented curriculum (graduating as a physician) to the long-term goals and objectives of the dental students (graduating as a dentist). This was a persistent theme, irrespective of the type of integrative process adopted. Comparisons of perceptions between the two types of integration did not show any perceptible differences. Similarly, subset analysis, including inter modular and intersystem evaluation, did not support any major significant differences related to integration. Students also showed an enhanced understanding of both faculty and content integration, and were aware of two emerging themes of: (a) competition within integrative environments, and (b) loss of discipline during the integration process. These are unexpected findings, and details entailing these phenomena are beyond the scope of the current research.

FACULTY MEDICAL EDUCATORS' PERCEPTIONS

This section is devoted to the presentation of the data obtained from the faculty medical educators.

Interview Participants

As per the research design of purposive sampling, the participants selected for the interview process were medical educators on faculty who actively participated in the integrative process of teaching pathology and laboratory medicine to first- and second-year students. In this context, four faculty medical educators were invited to participate in this study. In an attempt to maintain gender balance, two male and two female participants were chosen for this study. The teaching experiences of these four educators ranged between 15 and 20 years, complemented by active participation in various administrative roles in the undergraduate medical education at the College of Medicine. Nevertheless, for all interviewees, this was their first experience participating within an integrated medical curriculum.

Interview Data

As previously indicated, the purpose of this aspect of the study was to investigate the perceptions of the faculty to the varied concepts of an integrated medical curricular design and its values and demerits (including their satisfaction of the teaching experience), and assess the learning environment, with a focus on the three major research questions.

In addition to an hour-long interview, each participant completed a one page semi-structured questionnaire (as described in Chapter 3). This data, though available on a Likert numerical scale, is not being quantitatively analyzed due to the small sample size. This data, however, is summarized in the following paragraph.

The collective responses to the one-page questionnaire revealed that all four faculty were in complete agreement that the organizational structure of the integrated curriculum promoted increased faculty interactions and dialogue. This was also accompanied by a considerable increase to their individual teaching related workload. Yet all four perceived that it facilitated reflection on their individual teaching skills. All members agreed that this integrated curriculum promoted increased student engagement and student learning, with better holistic understanding of the human body's processes, which is well-suited to students' long term goals of becoming physicians. Faculty perceptions as to whether integration of the curriculum had direction, commitment, and motivation varied from disagreement to agreement. Integration was recommended to occur in steps or stages so as to achieve long-term results, with constant assessment to enable revisions and refinements, as encapsulated in the comment "to keep the curriculum fresh, updated and in step with scientific, clinical and or pedagogical developments." Student assessment was felt to be one of the keys to a successful integration. Inclusion of faculty members in all integrated curricular design decisions was strongly believed to have been absent, as well as a lack of faculty support for adapting to these changes in teaching and learning.

The discussion and analysis of the hour-long interview with each of these faculty members, according to the themes discovered from the interview research, is analyzed below. There were six themes discovered:

1. faculty members' perceptions of integration in medical education;
2. the influence of integration (advantages and problems) in medical education, including respect within integrative environments and the integrative team;
3. changes that educators are facing due to integrated delivery of medical education, including faculty fears, faculty stress, and faculty apathy;
4. educators' perceptions of the learning environment in relation to incorporating integration in medical education, including the role of technology and knowledge building and adaptive curricular changes;

5. forces that promote or inhibit the implementation of an integrated medical curriculum—i.e., the role of assessment, content, and time management; and
6. the perceived ideal use or benefits of integration in the curriculum to promote an enriched teaching and learning environment, including accountability and sustainability.

These themes are presented under the headings of each research question, though some themes may be common to more than one research question.

Themes Related to Research Question #1 From Faculty Members' Perspectives

What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum within a theoretical framework of the existing literature?

There appears to be varied understandings of what constitutes integration in the medical curriculum. The faculty members' perceptions of integration ranged from simple understandings of content integration to interwoven complex understandings of content and faculty integration through the various types of integration occurring chronologically (i.e., across time in a vertical fashion to a horizontal temporal alignment of subjects across the year). A simpler concept of building something into one course was also considered as a small way of integrating. Three faculty members admitted that horizontal alignment was easier to achieve than the vertical integration. The ideal situation, as suggested by the following comment, was "deliberate organization of the entire medical curriculum both within the year and across the years."

They also favoured the emerging concept of diagonal integration as another complementary integrative environment, focusing on parallel themes across the years. One faculty member remarked how "the latter years are difficult to be truly integrated due to time constraints and organizational resistance due to the impending need to move into postgraduate training." This refers to a future ongoing post-graduate career move for undergraduate medical students through the Canadian Association of Resident Matching Service that almost dictates the majority of the final year of a medical curriculum. This often results in fragmentation and disintegration of decisions regarding postgraduate specialization. This highlights how decisions of postgraduate medical education drive the curriculum of the last year of undergraduate medical education. Therefore, curricular integration can predominantly only be front-loaded (i.e., in the early years) in the

undergraduate medical curriculum. However, if we are to move towards a truly integrated medical education experience, we should, perhaps, think of the educative process as a continuum from undergraduate to postgraduate teachings.

It was also recognized that some areas had a "loose integration," while others were suitable for a "tight integration," and yet others may result in a "coupled" integration. Primarily, integration was discussed in terms of content integration, including decisions relating to the integration of topics and concepts in order to facilitate the organizational design of the curricular integration. Faculty participants also realized that for integration to be successful, committed content experts who buy into the concept of integration are a virtual necessity.

Themes Related to Research Question #2 From Faculty Members' Perspectives

What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum through the lens of the student participants in this study?

The responses to this question are embedded within the previously identified themes of:

1. the influence of integration (advantages and problems) in medical education, including the notion of respect within integrative environments and the integrative team;
2. changes that educators face due to such an integrated delivery of medical education, including faculty fears, faculty stress, and faculty apathy; and
3. forces that promote or inhibit the implementation of an integrated medical curriculum—i.e., the role of assessment, content, and time management.

These three themes are elaborated in part and then summarized in whole as they relate to the second research question.

The Influence of Integration (Advantages and Problems) in Medical Education

This will be discussed in terms of the advantages and problems as perceived by the faculty members.

Advantages to students.

All four faculty members believed that students could see "where they were going" in an integrated curriculum, and that this helped to provide a holistic view of the curriculum. They also recognized that it "focuses on concept building and reinforcement of learning." This therefore promotes deep learning with self-realization and understanding, and encourages "learning with

efficiency," as one faculty member remarked. Group activities further altered the student learning culture, encouraging ownership of learning. This was identified as positive feedback to an integrated curriculum. Different learning methods, including problem-based and case-based learning, were also discussed as teaching strategies. Remarks supporting varied teaching and learning strategies included: "giving the students the material to learn as opposed to engaging them in the learning"; "having the students think about what they are learning as opposed to memorizing what they are learning"; and "solving the problems—retain better."

Advantage to faculty

Perceived advantages to faculty members were alluded to in remarks such as "widens their horizon in terms of integration," and "you have to acquire some of their knowledge.(faculty)" Faculty participants were aware that content integration helps avoid unintentional, accidental, unimportant, or unnecessary repetition, as opposed to intentional explicit repetition of topics or concepts. An integrated curriculum was recognized as "promoting flexibility, adaptability," and as being "more dynamic."

The traditional curriculum was identified as being compartmentalized and focused on minutiae, rote memorization, and surface learning, and accompanied by a lack of perceived clinical relevance. However, some faculty members still felt that "traditional curriculum had building blocks of compartmentalized knowledge which provide a very strong foundational pile-driving building blocks" of knowledge construction in contrast to the loose, shifting sands within an integrated curriculum.

Problems

A major theme recognized by faculty, as with students, was "the loss of face of pathology" with "these changes and cutting down student hours and reducing teaching, and pathology being relegated to the 3rd or 4th tier , and anatomy kind of disappearing , and histology is not required is worrisome." Faculty also felt strongly that when they practiced evidence-based critical enquiry analysis there was no data to back this integrative teaching process. As one faculty remarked, "[T]hat worries me a little bit, well actually it worries me quite a lot but again, these decisions have been made and they probably are on their way to implementation—so the question here is implementation, not a question about decision."

Other problems recognized with curricular integration included the following:

1. establishing communication across faculty and "trying to break down barriers";

2. recognition of and valuing teamwork;
3. faculty educators have to "buy in for this change" and need to be encouraged to participate in this change, rather than be dictated to via top-down decisions and implementation;
4. faculty resource issues, with decreased faculty retention and increased faculty turnover, was recognized as a constant threat to successful integration; and
5. the process was recognized as being quite labour intensive and requiring a great deal of organizational structure. The overall perception was that for successful "content integration" and "faculty integration," a dedicated team effort would perhaps be most useful.

Questions regarding "how to construct the best team for the job" centered on team characteristics, and included such topics as:

1. Team size and group dynamics. Participants felt that five to six members was the right size for an effective "truly integrated" team.
2. Team leadership. Who and what choice of leader and type of leadership—distributive or centralized—and what are the roles? No consensus was arrived in this matter.
3. Content distribution. Who decides? How much should be represented? What is the focus of teaching and learning, generality or specialty? What is the content hierarchy within the limited distribution of hours? How do we manage content and information overload? How do we handle the technology explosion? Who decides the relevancy of content—is it academic, vocational, or clinical? How do we evaluate content for the integrated, inter-professional dental students, who have a different end point of goals and objectives?
4. Team structure. Who should be on the team–basic scientists, generalists, clinicians, and/or experts? Why? What is the role, if any, for inter-professional staff on the team, such as nurses or physical therapists? Some participants felt that a "mixture of both clinicians and basic scientists should make it a richer learning environment."
5. Team rules and team hierarchy.
6. Interfaculty communications, including group dynamics. Further questions that arose as part of this discussion included: Is there faculty ownership with faculty responsibility for the curriculum? Who is involved in the decision-making? Who has the true power to

effect change in structure? What is the level of faculty consultations and awareness of the ongoing status? How do we ensure that integration of the disciplines does not lead to a loss of the discipline?

Similar to the student perceptions, an emergent theme recognized by faculty was the concept of mutual respect within integrative environments. This was embraced broadly, beginning with: a healthy respect for the process of integration; to maintain respect in integration; to be respected for integration; to integrate with respect; and to be respectful of integration. Maintaining interfaculty respect at all levels with implicit to explicit collaboration of faculty is necessary for a healthy integration. In this context of interfaculty collaborations, they felt that true joint teaching efforts were "still quite fragmentary." Faculty recognized an alteration in the traditional power structure due to a blurring and transgression of boundaries with resultant dissipation of well known organizational hierarchies. This, they felt, has resulted in a new and unknown evolving chain of command. This was recognized as untested territory in the undergraduate medical curriculum, leading, in some instances, to disenchantment and distrust due to a lack of interdisciplinary and interprofessional mutual respect. These problems were faced by these medical educators in the implementation phase and will need to be resolved for continued maintenance and sustainability of integration.

Changes That Educators are Facing Due to Integrated Delivery of Medical Education

One of the dominant themes that kept remerging in all four interviews was related directly to faculty members' fear, apathy and resentment, and stress.

Fear

This was related to genuine persistent feelings that included:

1. A personal sense of the loss of identity as expressed in remarks such as "loss of the face of pathology" and "loss of discipline." The lack of a visible individualistic presence in the content and faculty was equated to a sense of "loss of the discipline itself," leading to a state of oblivion and despair.
2. Loss of power, control, and significance made faculty feel "disenfranchised in this process" of integration.

3. Loss of content. Faculty genuinely felt that this could easily happen unless a vigilant check was maintained. Such vigilance can be an extremely complex and bureaucratic process that involves monitoring for: (a) content, (b) structural effectiveness, (c) effective implementation, d) timeliness of integration, and (e) constant re-evaluation and renewal as required. This was recognized as a complex trade off to achieve true effective integration. These were the predominant thoughts of one faculty member who has a predominant role in the administration of the integrated curriculum.
4. Loss of accountability.
5. Loss of expertise.

Apathy and resentment

The faculty participants felt that a lack of consultation with an ad hoc team, a lack of faculty consensus, and top-down decision-making with minimal or no faculty awareness, buy-in, or discussion had resulted in resentment. Thus, the absence of faculty voices has led to this generalized apathy and resentment.

Stress

It is well recognized that adapting to change is stressful, which is compounded by forced change without consultation. Faculty members also felt a lot of stress with the prescribed task of managing content without prescribed guidelines. As one faculty member said, if one were to " reduce the content, and reduce the content hours, then you should also provide the learning outcomes you want your students to have, and once you do that, then its easy for the faculty member to exercise limited flexibility within that time frame and the content to meet those objectives." One faculty participant was of the opinion that the curriculum "should not be process directed, it should be outcome and foundation directed." Once again, in this context it is unclear who decides the foundation and the outcome. The answers to this and other such related questions are key pieces in this quilt of teaching practices, leading to the politics of decision-making.

One faculty member realized that the entire curriculum had the potential to fall apart "due to neglect or faculty attrition or changing faculty." Regeneration of an integrated curriculum is "very painful," and this adds further stress on faculty members.

Another challenge faced by faculty members is maintaining relevance for the topic/concept and managing student perceptions. Faculty participants felt that student perceptions are "that if the topic is not adequately represented and more so if not evaluated it is not important." Faculty felt that managing such student perceptions was extremely difficult because "their minds are closed and are driven by evaluation." Furthermore, as one faculty member remarked, it is a well-known adage in education that "evaluation drives learning." Thus, with pathology teachings dispersed throughout the curriculum, there was a real concern that the lack of spending time towards learning in detail may result in "leading to the lack of true understanding the disease process." As one faculty stated, "If you don't have that understanding, then superficial lists of signs and symptoms and diagnostic algorithms of what to do make you more of a *mechanized physician* rather than a person who can think and do things"

Forces That Promote or Inhibit Implementation of an Integrated Medical Curriculum

All faculty members favoured a dedicated team of "integration specialists" (approximately six members) devoted entirely to the design of an undergraduate medical curriculum and active involvement in curricular and assessment committees. They felt that this should be a dedicated and valued job with recognition in terms of promotion and/or tenure, and appropriate time and resource allocations.

Role of assessment

All faculty participants identified the lack of attention paid to the alignment of assessment processes with integrative processes as a leading pitfall in the current curricular integrative initiatives at the College of Medicine. An integrated curriculum needs a continuum of integrated teaching and learning with integrated assessment. Evaluation drives learning and content representation, and so its evaluation will dictate the implicit hierarchy of student learning. The output of any intervention is most important, yet it is also by far the most difficult aspect to measure in educational fields. An integrative learning environment calls for varied evaluations with varied assessments, which are primarily outcome focused. These are extremely labour intensive ventures.

A pass/fail system is currently adopted in the College of Medicine to promote collaboration. Yet, numerical grading of exams and for awards are endorsed, which continue to promote a competitive environment. This represents a major misalignment. The challenge is how to recognize

excellence in a collaborative environment without creating competition. One faculty participant remarked, “Is this an oxymoron and how do we provide feedback to the low achievers to buckle up?” Other questions that remain unanswered include: (a) how do we provide a fair assessment for integrated inter-professional dental students, who have different end goals and objectives, while maintaining respect within student groups? (b) what standardized nondiscriminatory evaluation tools are we going to use? (c) how do we truly assess this change when the evaluation tools are unchanged? and (d) what learning outcomes are required to pass the licentiate exams? As one faculty member said, “Students who get into medicine and for that matter any other profession are quite intrinsically driven to learn and they want to succeed.” Another faculty inquired, “ I wonder if these manipulations are within those boundaries and they never truly affect the student learning as once they know that this is what is to be done … they will do it, well either because or despite of what ever interventions we do.” This further complicates the research process by asking searching questions such as, how do we truly assess the effect of an educational intervention?

As we attempt to move from a competitive to collaborative environment, there is a paradox of environment being created concerning the outcomes being assessed that is present throughout the national and international levels of licensing and board examinations. This will require a major overhaul of assessments from top to down, to perhaps 360 evaluations including peers, patients, and staff members.

Content and time management

This was a topic of prominent discussion amongst all four interviewers. Content structuring and timeliness (principally effective time utilization) and the assessment of time management were recognized as problematic. Potential solutions discussed included alternative strategies of teaching and learning, such as experiential projects or online peer discussion and learning. It was felt that students and faculty needed time to readjust, rethink, and reflect when involved in such new ventures.

Themes Related to Research Question #3 From Faculty Members’ Perspectives

What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum through the lens of the faculty medical educators as key participants in this study ?

The answers to this research question are embedded in the two previously identified themes of: educators' perceptions of the learning environment in relation to incorporating integration in medical education, including the role of technology and knowledge building; and the perceived ideal use or benefits of integration in the curriculum to promote an enriched teaching and learning environment, including accountability and sustainability.

Learning Environment Changes

All faculty participants recognized that the contemporary classroom was not the student's only learning environment. Two participants held a holistic view, acknowledging students' social and financial environment as part of their learning environment. Furthermore, learning from peers, teachers, and other learning resources were recognized as alternative learning resources. Technological advances and the world being dominated by "just in time" learning and Google searches were discussed. Change in current teaching practices was understood by this remark: "we have to give the students the knowledge and the tools to check the same." This availability of free information recognizes the new sets of rules for "free information usage." The role of email and its etiquette, with faculty complaints of it "eating up our time" raises awareness of the ever-looming problems of time management and technology. Increasing student-faculty e-mails also compounds this issue. In this context, the downloading effect onto the faculty of this free universal global portability and availability of these technological resources is another large problem with respect to faculty time management.

All four interviewees felt that there was less contact time with students. One faculty participant remarked that "the intangibles are not learnt," leading to the danger of "students acquiring theoretical knowledge and lacking practical knowledge and the exact know how!"

Two faculty members were also puzzled as to "what were the drivers for this change?" They explored this through questions such as: "Is it health care costs? Or is it just a process change? Does it produce a better physician? Is this intervention effective? What was wrong before to fix?" However, despite these reflections, their comments included: (a) "it is too late as we are in the implementation phase", (b) "the train has left the station and is already moving", (c) "I think at least in our context, the Health Region and the College of Medicine should have a more coherent statement on what is the purpose of undergraduate and the postgraduate medical education here" in Saskatoon, and (d) "what is it that you are trying to achieve?"

Role of Technology

The implications and role of technology were explored. Two faculty members had mixed feelings on the indiscriminate usage of new technology. Their remarks include: (a) "burden on the unfamiliar teacher and is an academic freedom issue with the right to say yes or no to its usage", (b) "up to an individual to develop their style:", (c) "the aim is to get the student to make sense of it", and (d) "I'm worried that teaching may get to the point where the instructor has a minimal role in all of this. I think that the instructor dependent teaching to instructor independent teaching is not where we want to go. We want to go to instructor independent learning with student centered decisions in lieu of teacher centered decisions—bringing the students and teacher together in the learning experience is a great idea and needs to be encouraged."

All four faculty participants recognized that the role of the classroom had altered, yet it was felt that the focus should be effective delivery of the curriculum with effective learning by the students, not the technology per se. Use of a virtual classroom was discussed in terms of gain and what might be lost. On the whole, it was not felt to be suitable for an interpersonal contact profession like medicine. It was believed that the discipline should "embrace technology appropriately rather than embrace it unconditionally." As one faculty member said, "I'm not aware of any formal study which says this effects the 'true' learning or not. Remember these are all type 'A' personalities, they will learn whichever way they want to learn. So you also understand the limitation of assessment of the educational intervention."

Knowledge Building

Knowledge construction was a theme inherent in remarks such as "integrated curriculum provides a kind of a framework to link everything together—so that linkage is happening, solidified and retained." Faculty members felt that integration provides an efficient way of acquiring this knowledge, and that "we can actually build on that and do things better." This, they felt, "is completely independent of what technology you use and you may need to guide them, you may need to cajole them, but … develop different strategies for that to be part of the process of their learning." Faculty participants also perceived that knowledge was not static, and that many different avenues were available for the construction of this "connective knowledge," including technological resources. In this context, faculty members perceived that technology had its limitations because:

(a) it could fail or crash and thus be unavailable, (b) the novelty effect could wear off with time, and (c) it is time consuming. Many of the faculty members recognized that, while it may have the potential to shorten the "contact lecture time," as an instructional strategy it is extremely labour intensive and may not be worth all the effort in terms of its benefits.

One faculty member of the medical curriculum likened it to learning a new language. The basic science blocks are like the a-b-c's, which are soon strung together in sentences. Soon, a person does not even think about it. Later, the same knowledge is applied to writing poetry and novels. Yet, it was strongly stated that it is imperative that the building blocks are well anchored in the curriculum, just like the a-b-c's. As one faculty member argued, "this is how we justify retaining these disciplines in this integrated curriculum where we provide the A,B,C in conjunction with the clinicians thereby providing contextual learning to maintain relevance of the learning material." Thus a careful and thoughtful integrative curriculum that addresses all these aspects is needed for success.

Accountability and Sustainability

Curricular integration is practically mandatory due to societal pressures and social accountability expectations of doctors. Because patients have easy accessibility to information, an integrated team approach to health care is the only viable solution. This necessitates early integration of the notion of being a team player. Thus, measures may include explicit visible integration, which overlies the implicit invisible integration being pitted against the inherent societal hierarchy rules and protocols. At the other end of the spectrum of this accountability lies the complex process of monitoring that will ensure that integration does not fall into a state of disintegration (Figure 4.1). One participant explored this conundrum in depth. Figure 4.1 provides a conceptual framework of the links between integration, accountability, and monitoring as they were discussed and understood from the interview proceedings.

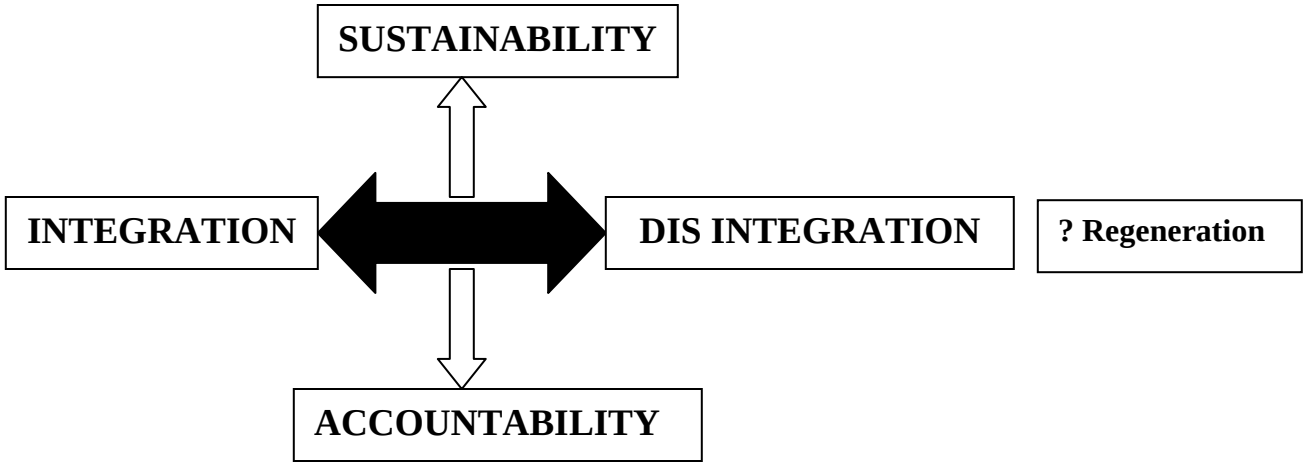

Figure 4.1. The interweave of integration and disintegration to sustainability and accountability

Finally, an overall holistic comparison of the perceptions of students and faculty members to the creation of an integrated curriculum design revealed two unexpected but interesting emergent themes. The perceptions of the two groups were quite different in topics of educational interest, resulting in a "perception gap," which was accompanied by the presence of the "generational gap." Though they will be explored further in Chapter 5, these are complex issues that are beyond the scope of the current research design, and need to be explored and studied independently.

SUMMARY

This study has utilized comparative quantitative and qualitative research inquiry techniques to explore the newly integrated teaching of pathology in the medical curriculum. Student data analysis has identified some of the advantages and disadvantages of this educational intervention. The voices of faculty members provided a different perspective to the same issue, including the revelation of seemingly unrelated but important topics such as respect and competition within integrative environments. A fascinating but unexpected finding of this research is the recognition of a prevalent perception and generational gap that impacts the final success or failure of such educational interventions.

CHAPTER 5
Summary, Conclusions, and Implications

INTRODUCTION

In this final chapter, the research study is reviewed from its conception to the birth of a pre-research conceptual framework, to its growth phase of data collection, and finally bearing fruit with a post-research conceptual framework inclusive of the research data with interpretation and summarization. There is also ongoing reflection with plausible explanations for some of the expected and unexpected findings observed, as well as some concluding implications of this study for the future.

SUMMARY OF THE STUDY

This section provides a brief review of the study from its origins in a literature search to support the research questions, proposed methodology, and research design, resulting in the pre-conceptual framework. Data collection and analysis resulted in further modification of the original pre-conceptual framework to the evolution of the post research conceptual framework.

The Conception

As a medical doctor I have spent the last thirty years in the various disciplines of clinical medicine in four different countries, and has been exposed to many different models of undergraduate and postgraduate medical education, both as a student and a faculty medical educator. The current changing curricular reforms at the College of Medicine in Saskatoon are moving towards the construction and implementation of an integrated undergraduate curriculum. As a fulltime faculty member in the Department of Pathology, I am actively involved in the teaching, course design construction, and related administrative duties of the pathology courses for first-, second-, and third-year students. With the changes being implemented, I felt that the time was right to pause and conduct a holistic review of the multiple roles of integration in medical education, with special emphasis on the future of teaching pathology and laboratory medicine in the revised integrated undergraduate medical curriculum. This study was thus conceived in my deep restless labyrinth mind with a wish to further potentiate the understanding of student learning and the world of integration in medical education through the perception lenses of both students and faculty medical educators. Thus began my journey with a Masters thesis dedicated to this quest including a

detailed literature search on the roles of integration in medical education, with special reference to theories of curricular integration, the teaching of pathology in the past, present, and foreseeable future, and its effect on the student learning environment.

The Pre-Research Conceptual Framework of the Study

In an effort to develop the best practice plan for designing a curricular instruction of pathology, the following were recognized as the four pillars of the conceptual framework of this study: (a) the role of integration in medical education; (b) the role of pathology teaching in the past, present, and future; (c) the theories of curricular integration; and (d) the current student learning environment.

The overall research objective of this study was to investigate the advantages and disadvantages of two models of horizontal and vertical integration in the teaching of pathology through an analysis of the perceptions of individual medical educators and first- and second-year students at the College of Medicine in Saskatoon, based contextually within the theoretical framework of the newly designed medical curriculum and with a focus on three research questions (Figure 2.1).

Research Design and Methodology

A robust research design was created within this study's conceptual framework. This included a triangulation of research methodology with: (a) multiple data sources (survey questionnaires, focus groups, and interviews); (b) multiple subjects (medical and dental students, and faculty medical educators); and (c) multiple points of data collection (similar data collected at multiple points). Research instruments included customized survey questionnaires for students in the three pathology courses included in the study and a survey questionnaire for faculty/medical educators. Comparative quantitative and qualitative research inquiry techniques were used to understand, engage, explore, and learn about the advantages and disadvantages of the newly integrated teaching of pathology in the medical curriculum through the voices of the students and the faculty/medical educators.

Data Collection

Perceptions of the four faculty medical educators were summarized from the collective responses to the survey questionnaires and from their hour long, semi-structured guided interviews. Student perceptions were derived from the collective responses to survey questionnaires in three courses over multiple data points. Detailed relevant statistical analysis was carried out on the quantitative student data sets to answer the proposed research questions. Focus group interviews were also conducted with voluntary students in the first and second years of undergraduate study. All qualitative data were categorized into themes to answer the respective research questions.

Summary of Findings in Response to the Guiding Research Question

The larger research question of this study was to investigate the advantages and disadvantages of two models of horizontal and vertical integration in the teaching of pathology through an analysis of the perceptions of individual medical educators and first- and second-year students in the undergraduate curriculum at the College of Medicine in Saskatoon, based contextually within the theoretical framework of the newly designed medical curriculum. The collected data are summarized below through the lens of students' and faculty members' perceptions.

Through the Lens of the Students

Overall, the students appreciated the variety of the integrative practices of the curriculum, with evidence supporting both horizontal and vertical styles of integration in the medical curriculum as they complemented each other in the overall domain of student learning satisfaction. Yet, students, both dental and medical, perceived a considerable lack of alignment of the newly designed courses to their final assessment and evaluation outcomes. Integrated curricula facilitated and encouraged overall student engagement through a variety of active learning strategies promoting student interactions, with a shift towards student-centered, self-directed learning. Explicit attempts at integration were also successful in the areas of increased contextual learning through vocational relevance, thereby promoting deeper learning with understanding, especially for medical students.

A recurring concern by all students was that of inefficient time management in these integrative sessions, coupled with focal areas of content overload. The second-year medical students further noted marked disparity of student expectations versus instructor expectations, which were,

in part, related to the multiplicity of course instructors in the second-year curriculum compared to first-year teachers. These students also questioned the existence of the teaching of pathology as its own entity because more of this content was being embedded into the clinical context and not addressed at the basic grassroots of pathological microscopic evaluation. These students also noted fragmentation and competition within so-called integrative environments. Such competing values were interpreted as being negative experiences with regards to their overall learning satisfaction.

Though students shared many similar perceptions and concerns, there were some marked differences. The most significant differences between the first- and second-year medical students were their perceptions of student stress and engagement in active learning endeavors. This is probably directly related to: (a) their maturity levels in relation to awareness and familiarity with the integrative process, and (b) the paradigm shift from a competitive to a collaborative learning environment and a Pass/Fail system in the overall undergraduate medical curriculum.

Significant differences of perceptions were also noted between first-year medical and dental students. These differences persisted irrespective of the horizontal or vertical model of the integration process, suggesting a more central common causal explanation of these findings. The overall perceptions of student learning satisfaction, learning for understanding, the learning environment, student engagement, self-directed learning activities, and alignment of goals and objectives were significantly different between the two student groups despite both being exposed to the same integrated curricular activities. This is being attributed directly to the lack of academic and vocational relevance for the contextual learning environment of the dental student, resulting in a non/mal-alignment with their destined long-term goals and objectives. Thus, in a multi-goal directed, inter-professional student population, the current integrated curricular activities that are aimed primarily at the medical student does not provide an efficient or productive learning environment for dental students. This information has led to the creation of a separate course for the next batch (2007-2008) of dental students. As stated in Chapter 3, this is one of the advantages of focused monitoring of the research design—the "creation of rapid responsive evaluation" that has resulted in "improving the quality of" the curricular program (Mangano, 1990, p. 25).

In terms of perception comparisons between the two types of curricular integration, there were no observed differences between the students participating in the horizontal and vertical integrated models of curricular instruction, except in the domain of student reflection and

engagement. This was felt to be process related to the variety of teaching strategies utilized rather than to the organizational integrative environment of the course.

Some significant differences were observed in the different components of the inter-modular comparisons among first-year students and the intersystem comparisons among second-year students. One module and one system in each of these comparisons was an outlier, and many explanations are plausible to explain this aberrant finding. Some of these multi-factorial causes that explain this observed difference include variability in: (a) teaching techniques, (b) teaching faculty, (c) assessment techniques, and (d) other such confounding factors. In order to understand and explore this specific aberration, a study that controls some of the variables highlighted would be needed to obtain meaningful interpretation.

All students in both years and all three courses fared comparably well on the final grade performance, emphasizing the inherent bias, perhaps, that these professionally driven students would do well in their assessment tools, no matter what instructional changes are studied as an innovative educational intervention.

Through the Lens of the Faculty /Medical Educator

The collected responses of the interviewed faculty members were strongly in favor of the integrated curricula. They felt that it promoted a positive learning environment with a more holistic understanding of human body processes and was aligned with the long-term goals of becoming a physician. However, they recommended that integration should be incorporated in small steps and defined stages to achieve compliance and success. All faculty participants universally acknowledged the increase in their workload, along with stress, apathy, and fear. This was, perhaps, linked to a lack of consultation in the decision and implementation process (as mentioned by one faculty member), which resulted in the involved faculty members feeling disenfranchised, resentful, and apathetic. Respect within integrative faculty environments with a changing power structure and organizational hierarchy was a prominent source of concern for those faculty members interviewed. Such conflicts are perhaps deeply rooted in the individual belief and value systems of the diverse faculty participating in the team, something that may need to be better understood for effective functionality. As Massey (2005) stated, these values become programmed during our childhood and adolescence and are different for each generation.

The overall consensus was that a successful integrated curriculum would need a strong team with distributive leadership skills and teamwork. In fact, it was felt that the key to successful implementation of integration was to find "team players," not "excellent teachers."

One of the foremost fears of faculty participants was related to a loss of identity within the integration, with a potential threat to loss of face, power, and value of their discipline. These were mirrored by many of the student perceptions, which dealt with a lack of importance for certain disciplines as content melds and merges, and gets lost in the integration.

Another major flaw of the current integrated curriculum was that of the non-integration of the assessment process, and lack of alignment in the learning cycle from setting goals and objectives, delivery, and assessment. The creation of an "outcome based integration" (where the end products of the learning process must be decided before learning takes place, and target methods to achieve the same) rather than a "process driven integration" (where the focus is on methods—horizontal, vertical, or diagonal integration, with the hope that the end product is achieved) was suggested as a more suitable option for undergraduate medical education.

Lastly, curricular time management was felt to be ineffective in some areas for both students and faculty. In summary, though faculty members recognized that an integrated curriculum had facilitated an overall enriched learning environment with increased intentional student engagement and student-centered learning, it had paradoxically resulted in faculty disengagement. Furthermore, the two biggest fears underlying this curricular integration were: (a) sustainability in the face of faculty loss (explicitly by reduction or attrition, and implicitly by disengagement); and (b) accountability and monitoring of this process to ensure that key subject content is still represented and evaluated. As one faculty participant aptly summarized, this is a "complex, bureaucratic and daunting task."

Post-Research Conceptual Framework

The pre-research design to answer this study's research questions was based on the exploration and understanding through the perception lens of both students and medical educators concerning: (a) the role of integration in medical education; (b) the role of pathology teachings in the past, present, and future; (c) the theories of curricular integration; and (d) the current student learning environment. These formed the four pillars of the pre-research conceptual framework of this study's research methodology (Figure 3.1).

The relevant answers to these research questions resulted in the post-research conceptual framework depicted in Figure 5.1.In the context of theories of curricular integration, positive student and faculty perceptions were observed for both horizontal and vertical integration environments, as observed by Vidic and WeitLauf (2002). The research data obtained support a composite combined integration approach with a careful use of horizontal, vertical, and diagonal integration throughout the undergraduate medical curriculum (Figure 2.3). As this research suggests, this has to be done judiciously, in measured steps to ensure stability and the viability of both the process and organizational structure. The key for success will thus be to strike the right balance between traditional and these proposed curricular innovations in relation to student learning and understanding.

In the context of exploration of integration in medical education, factors that were highlighted in this study included aspects related to content integration, faculty integration, respect, power and team organization in integration, and the evolving concept of perhaps shifting towards an outcome-based integration rather than process-based integration. The perceptions of student and faculty to these domains were not always similar. Though integrated teaching has been suggested as a key tool in the delivery of an effective educational program (Harden, Susette, & Dunn, 1984; Schmidt *et al*., 1996), one of the continuing challenges facing integration is "content integration," with ongoing debates regarding content elimination and quantification of material taught which is difficult to define and measure. The data obtained regarding aspects of faculty integration, particularly concerning respect and power structure in integrative team environments, were discovered during the study. Such themes have been well documented and observed in many organizational studies from business circles (Lawrence & Lorsch, 1986). Although power structures in the hospital organizations have been studied (Teulings, Jansen, & Verhoeven, 1973), this remains a relatively unexplored territory in the field of undergraduate medical education and should, perhaps, be the focus of specialized study in the future.

In the context of exploring the teaching of pathology in the integrated curriculum, key factors that emerged included loss of faculty, loss of discipline, loss of power and content expertise, and effective content management versus effective time utilization. This trend of the loss of pathology identity and reduced pathology curricular hours is similar to that observed by Kumar, Daniel, Dig, and Agamanolis (1998) and Kumar, Indurkha, and Nguyen (2001). Further observed trends included an awareness and recognition of competition in integration and the features of

accountability and sustainability in the curricular integrative innovations. These trends merit further study. Dissimilarities were observed between student and faculty perceptions. While this was not part of the primary research objective, it is discussed as an interesting and evolving concept of this study for awareness, recognition, and future targeted study.

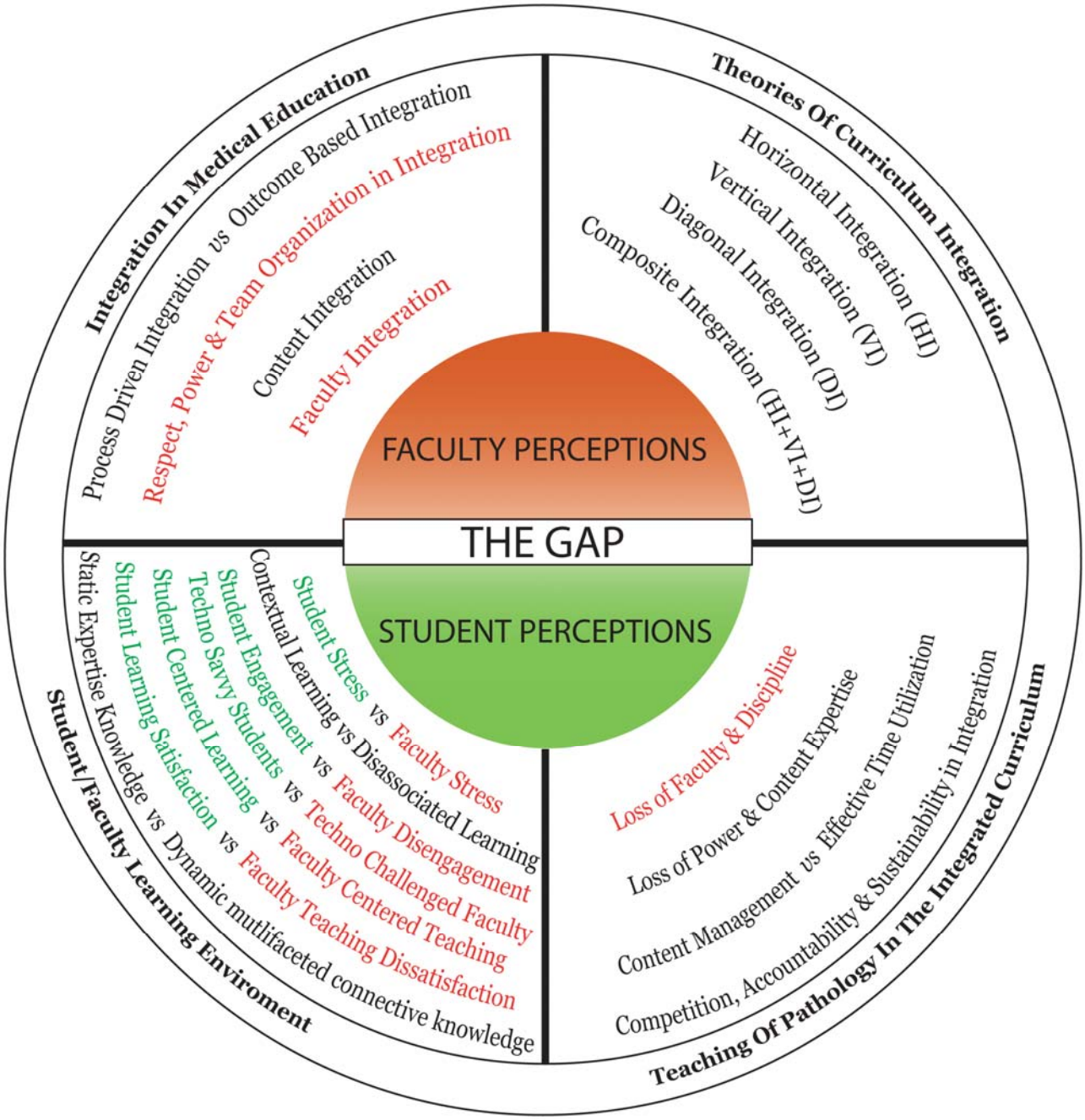

Figure 5.1. Post-research conceptual framework

The perception gap was most apparent in the context of the learning environment for this was one of the fundamental elements studied in this research. Key perception gap factors of

students and faculty included: student stress versus faculty stress; contextual learning versus disassociated learning; student engagement versus faculty disengagement; technology-savvy students versus technology-challenged faculty; student-centered learning versus faculty-centered teaching; student learning satisfaction versus faculty teaching dissatisfaction; and recognition of the existence of traditional static expertise knowledge versus the current dynamic state of multifaceted connective knowledge (Figure 5.1). Thus, the overall unexpected emergent theme from this study is termed "The Gap" (Figure 5.1), which exists between the perception of students and faculty.

Student and faculty expectations did not align in many areas of curricular design principally within the three broad areas of effective utilization of time, assessments, and content management. In the context of student learning environment, the proposed explanation of this observation is perhaps related to the recognition of the generational learning gap between students and faculty. Most medical students today belong to the early Millennial (born 1981-1999) generation and some to the last portion of Generation X (born 1965-1980). On the other hand, most faculty members come from the Baby Boomer (born 1946-1964) and some from the Traditionalist (born 1922-1945) generations (Worley, Cooper, & Fiser, 2004). Similar to what occurs in society in general, generational characteristics influence the interactions between faculty and medical students, and the perceptions they have of each other.

In the discussion of faculty perceptions of medical student characteristics, it is perhaps important to be mindful of these generational differences. It is primarily due to these differences that the approach taken to studying medicine by today's students is strikingly different from that by faculty during their own student days. Student goals are more likely to be short-term, while faculty goals are long-term. Students often remark, "the course pack is too extensive," or, "the lectures give too much material [and] should be more focused." This content stuffing is a well-recognized phenomenon that needs to be discouraged (D'Eon & Crawford, 2005). Yet, the perception, as interpreted by their instructors, is that the students want "pre-digested information to cover only what is needed to pass the next examination." One faculty member remarked, "students need to be weaned away from the misconception that pathology is restricted to morbid anatomy, histopathology and musty dark smelly laboratories." If the course covered only those aspects, it would be meaningless, as the students would not integrate that information into the other disciplines.

Pathologists hold a very special place in medical school curricula. They teach their discipline in both pre-clinical and clinical years, and their contact with students as they progress through four years of training is extensive. There is a prevalent belief among some students that the preclinical years are of limited value for their future practice of medicine. Pathologists, who bridge the basic and clinical sciences, must enlighten them to the fact that the basic sciences in general and systemic pathology in particular, provide the foundation for understanding the impact of disease on patients and dictate their ultimate treatment. As part of this, students must come to realize that pathology integrates all the basic sciences and is the basis for all clinical sciences. It provides the very skills needed to formulate a differential diagnosis. Thus pathology teachings being inherently integrative in nature are ideal for curricular integration.

Students need to understand that what they are learning at the present time will be useful in their clinical practice in any branch of medicine. They must not and cannot close the book or purge their memory after every test because they are learning for a lifetime. Given the intensity of medical school curricula today, students in their first two years of study often focus only on the next upcoming exam. As a result, they often postpone studying for any given discipline's material until just before the next exam. Faculty, meanwhile, continually provides new material in all ongoing classes. Frequent quizzes during the term may be a partial solution, but some more creative strategies need to be devised to break this bulimic cycle of learning (Rader, 2007, p. 7). Recognition of The Gap suggests that it might be valuable to reserve some time in the undergraduate curriculum for an open discussion of issues related to differences in generational attitudes, faculty expectations, current learning environment, and learning styles. Inclusion of such an intergenerational component in curriculum organization is recognized as a means of improving interaction between the generations in the "changing demographics of the learning environment" (National Oceanographic and Atmosphere Association Office of Diversity, 2005.). Such strategic measures will help to bring closer together the Traditionalists, Baby Boomers, Generation X, and Millennials, and help them understand and explore the values, beliefs, strengths, and weaknesses of each, leading to more positive and meaningful interactions for all (Worley, Cooper, & Fiser, 2004). Another plausible explanation for this perception gap could be related to not only differences in individual learning styles but also, in part, to the well recognized learning differences that exist among experts (faculty) and novices (students) (Bransford, Brown, & Cocking, 2002).

This awareness of the differences in perceptions and attitudes between generations of students and faculty is worth celebrating. The climate of four co-existing generations offers challenges and risks as well as opportunities to tap into this rich mix. By better understanding the differences in belief systems and perception and generational learning gaps, educators can, perhaps, design more effective educational systems in terms of content, process, and outcomes. As learning is the central function of all education, the key lies in finding the right balance between faculty expectations and student needs when designing effective learning environments.

CONCLUSIONS AND IMPLICATIONS

Conclusions

In conclusion, this research study on the exploration and evaluation of student and faculty perceptions of a curricular educational intervention has provided useful information for curricular improvement. This form of rapid monitoring evaluation has resulted in some immediate improvements in the curricular design of this first-year course.

The results of this study strongly support an overall balanced composite curricular design (including facets of horizontal, vertical, and diagonal integration) that meets the needs of the student learner and satisfies the expectations of the faculty medical educator. As pathological concepts are the scaffolding blocks upon which all diseases are fundamentally diagnosed and treated, authentic horizontal, vertical, and diagonal integration of pathology teaching throughout the four-year program of undergraduate curriculum (Figure 2.3) continues to be the best practice plan of curricular instruction of pathology in the newly designed integrated medical curriculum.

Finally, this study has uncovered certain perception gaps that prevail amongst faculty medical educators and students, and that these are key factors that influences the outcome of any educational interventions. This was not considered in the initial research design. However, this will need to be addressed in future research designs.

Implications

The proposed implications of this study for theory, practice, and future research endeavors are summarized below.

The implications of this study for theory concern the perception gap regarding the process of integration in the undergraduate medical curriculum, possibly because different medical

educators approach such educational interventions differently, which may relate to the nature of their individual work and related expectations.

The implications of this study for practice indicate consideration for the development of a team of "integration specialists" to be actively involved in curricular development, reform, planning, mapping, and design based on models of diagonal, horizontal, and vertical themes of integration. Methodologies and teaching strategies have to be designed to function in a new world of knowledge building that is no longer static and expert dependent. As we shift from this traditional view of "static knowledge" to "connective knowledge," educators must acquire new teaching and learning skills appropriate for survival in the current dynamic, multifaceted state of knowledge creation, which is all about the power of connections, sense-making, and pattern recognition.

The implications for future research include collating ideas and developing a best practice plan for pathology integration in undergraduate medical education at a national level for various medical schools in Canada. Future research endeavors might include research into: (a) exploring the outside pressures that educators feel when implementing curricular reforms; (b) designing the ideal model for enhancing students' learning environment; (c) exploring the characteristics of an effective integration team with dedicated integral specialists; and (d) exploring the values and contributions of such experts in undergraduate medical curriculum planning, not only at a local level but also for promotion of perhaps a universal national undergraduate medical curriculum design.

Thus, in conclusion, it is speculated that what is needed now and in the future are research endeavors that can bridge the gap between theory and practice. These endeavors could focus on the theoretical concepts underlying integration, such as searching for a clearer understanding of how integration does or does not work. They could also further explore where and under what circumstances in undergraduate medical education the integration would be most effective. Such studies could, perhaps, provide us with guidelines as to how to deal with the unexpected features encountered in integration practice, like competition and power structure in integration.

More research also needs to be conducted to find out how integration can stimulate and facilitate students towards constructive, self-directed, collaborative, and contextual learning. However, more theory-based research does not imply that which is detached from practice. What is needed, perhaps, is research that bridges theory and practice, and extends knowledge about developing and improving integrated medical education in everyday practice. Perhaps design-based

research, wherein answers to how different learning environment designs affect dependent variables such as environmental (student engagement, student control, collaboration versus competition), learning (content knowledge, skills, learning strategies), and systemic (sustainability, ease of adoption, costs), can be explored using mixed methods and triangulation of multiple sources and types of data (Barab & Squire, 2004). As learning is the central function of all education, perhaps the future of successful medical educational research environments are those in which students-as-researchers and medical educators can work closely together and engage as true joint partners in their research endeavors. This may also facilitate a reduction of the perception gaps between student and faculty medical educators thus providing a more effective student learning environment.

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APPENDICES

APPENDIX 3.1 Student Questionnaire for ITDL 206.18-Modules 7, 10 & 12

THE MODULAR INTEGRATION OF PATH & LAB CONTENT
STUDENT QUESTIONNAIRE

Medical Student ☐ (YEAR I) Dental Student ☐

1=Strongly disagree; 2=Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

Please circle the extent of your disagreement or agreement for each of the following statements.

		Strongly Disagree				Strongly Agree
1.	**The introduction of Path & Lab content** in this module facilitates **my learning.**	1	2	3	4	5
2.	The **introduction of Path & Lab content** in this module helps me **understand concepts** of basic pathological processes in relation to their normal anatomy and physiology.	1	2	3	4	5
3.	The **integration of Path & Lab content** in this module helps me **construct meaning** into the link of pathological processes from the normal to the disease states.	1	2	3	4	5
4.	I am **satisfied** with the **integration of Path & Lab content** in this module.	1	2	3	4	5
5.	The **integration of Path & Lab content** in this module enhances the **effectiveness of my study skills.**	1	2	3	4	5
6.	The **integration of Path & Lab content** in this module helps me to **understand and problem solve** the case based questions in this module.	1	2	3	4	5
7.	The **Path & Lab content** in this module emphasizes **application of knowledge** rather than simple recall of factual knowledge.	1	2	3	4	5
8.	Overall I am satisfied with the **organization** of **Path & Lab content** in this module.	1	2	3	4	5
9.	The integration of **Path & Lab content** in this module has contributed to my overall **educational growth** and development.	1	2	3	4	5
10.	The **integration of Path & Lab content** in this module has facilitated enhancement of my **analytical thinking skills**.	1	2	3	4	5
11.	The **integration of Path &Lab content** in this module is an **efficient use of my class-time.**	1	2	3	4	5
12.	The **integration of Path &Lab content** in this module has contributed to **my learning.**	1	2	3	4	5
13.	There were **clear goals and objectives f**or the **Path & Lab content** in this module.	1	2	3	4	5
14.	The exam questions for the **Path &Lab content** in this module were matched to their **goals and objectives.**	1	2	3	4	5
15.	The **learning climate** of the classroom in this module is **positive.**	1	2	3	4	5
16.	I found the **workload r**elated to the **Path & Lab** component to be **stressful.**	1	2	3	4	5
17.	**Integrated Path & Lab content** in this module is moving towards being **learning centered** rather than being **content centered.**	1	2	3	4	5
18.	The **integration of Path &Lab content** in this module enhances my **motivation to learn.**	1	2	3	4	5
19.	The **integration of Path &Lab content** in this module **encourages student engagement** in the classroom.	1	2	3	4	5

APPENDIX 3.1 Student Questionnaire for ITDL 206.18-Modules 7, 10 & 12

		Strongly Disagree				Strongly Agree
20.	**Integration of the Path &Lab content** in this module encourages **active learning opportunities (in class questions, discussion, group activities).**	1	2	3	4	5
21.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** encourages my **independent study.**	1	2	3	4	5
22.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** provides me with opportunities for **interpersonal learning activities.**	1	2	3	4	5
23.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** encourages me to **reflect on how I am learning.**	1	2	3	4	5
24.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** encourages **reflection** on the **content material** discussed**.**	1	2	3	4	5
25.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to question** what I hear in lectures.	1	2	3	4	5
26.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** encourages me to **relate ideas** in one discipline to those in another discipline.	1	2	3	4	5
27.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to be cautious** about drawing conclusions unless they are well supported by evidence.	1	2	3	4	5
28.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** promotes rote memorization of important facts **(memorization by repetition without comprehension)**.	1	2	3	4	5
29.	**This multidisciplinary module (anatomy, physiology, embryology, histology, pathology)** is **not** well integrated.	1	2	3	4	5
30.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** has facilitated the move from time **spent in formal classes to time spent in independent study.**	1	2	3	4	5
31.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology)** has provided an opportunity for **the choice in the school work to be don**e.	1	2	3	4	5
32.	There are op**portunities for teaching staff to provide helpful feedback** in this **multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module.**	1	2	3	4	5
33.	**Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module** uses a variety of **learning strategies** that work for me.	1	2	3	4	5
34.	**I am rarely bored** in this multidisciplinary learning environment.	1	2	3	4	5
35.	**The teaching** in the integrated curriculum **is well focused.**	1	2	3	4	5
36.	I feel the **multidisciplinary integrated approach (anatomy, physiology, embryology, histology, pathology)** is **preparing me well** for my profession.	1	2	3	4	5
37.	**I feel comfortabl**e in the classroom learning environment of this module.	1	2	3	4	5

APPENDIX 3.1 Student Questionnaire for ITDL 206.18-Modules 7, 10 & 12

		Strongly Disagree				Strongly Agree
38.	The atmosphere is **relaxed** during the lectures in this module.	1	2	3	4	5
39.	The **contact teaching time in this multi disciplinary integrated module** is utilized effectively.	1	2	3	4	5
40.	I find the multi-integrated classroom **experience stimulating.**	1	2	3	4	5
41.	The **classroom teaching styles in this module encourage**s me to be an **active participant in my learning.**	1	2	3	4	5
42.	**The multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology)** has shown me how much of what I learn today seems **relevant** to my future training for a career in healthcare.	1	2	3	4	5
43.	**Multidisciplinary integrated teaching** has facilitated me to **interact easily** with other students in my class.	1	2	3	4	5
44.	I find that the **multidisciplinary integrated curriculum** has **increased my stress load**.	1	2	3	4	5
45.	The **multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology)** teaching has **helped me** to recognize the interrelationships within and between the various disciplines.	1	2	3	4	5
46.	Overall I have learned with understanding a great deal **in this multidisciplinary integrated module.**	1	2	3	4	5
47.	I consider what I learned in this **multidisciplinary integrated** to be **valuable** to my future training for a career in healthcare.	1	2	3	4	5
48.	Overall I am satisfied with the **quality of Path & Lab content** in this **multidisciplinary integrated** module.	1	2	3	4	5

OPEN ENDED FREE RESPONSE QUESTIONS

1. What aspects of this module have facilitated to your learning with understanding?

2. What aspects of this module did you like the most?

3. What aspects of this module should be altered in the future?

4. Any other comments or suggestions?

APPENDIX 3.2 Student Questionnaire for PATH 201 at Midterm & Final Exams

THE GENERAL PATHOLOGY COURSE 201.3--STUDENT QUESTIONNAIRE MIDTERM

Medical Student ☐ **Dental Student** ☐

1=Strongly disagree; 2=Disagree; 3= Neutral; 4 Agree; 5= Strongly agree

Please circle the extent of your disagreement or agreement for each of the following statements.

		Strongly Disagree				Strongly Agree
1.	**Pathology teaching** in this course **facilitates my learning**.	1	2	3	4	5
2.	**Pathology teaching i**n this course helps me **understand concepts** of basic pathological processes in relation to their physiological and anatomical basis.	1	2	3	4	5
3.	**Pathology teaching** in this course helps me **construct meaning** into the link of pathological processes from the normal to the disease states.	1	2	3	4	5
4.	I am **satisfied w**ith the organizational structure of the **integrated approach of pathology teachin**g in this Term II Pathology **stand alone course.**	1	2	3	4	5
5.	The **pathology teaching** in this course enhances the **effectiveness of my study skills.**	1	2	3	4	5
6.	The organizational **structure of integrated pathology teaching** helps me to **better understand and solve the case-based questions** in the exams for this course.	1	2	3	4	5
7.	The **examination questions** for this course emphasize **application of knowledge** rather than simple recall of factual knowledge.	1	2	3	4	5
8.	Overall I am **satisfied** with the independent **integrated structure of pathology** teaching in this course.	1	2	3	4	5
9.	The **pathology teaching** in this course has **c**ontributed to my overall e**ducational growth and development.**	1	2	3	4	5
10.	The **pathology teaching** in this course facilitates enhancement of my **analytical thinking skills.**	1	2	3	4	5
11.	The **pathology teaching** in this course is an **efficient use of my class-time**.	1	2	3	4	5
12.	The **pathology teaching** in this course has contributed to the ***quality* of my learning** this term.	1	2	3	4	5
13.	There were **clear goals and objectiv**es for this course.	1	2	3	4	5
14.	The examination questions were **matched to the goals and objectives of** this course.	1	2	3	4	5
15.	The **learning climate** of the pathology teaching classroom is **positive.**	1	2	3	4	5
16.	I found the **workload r**elated to this course **stressful.**	1	2	3	4	5
17.	**Pathology teaching** in this course is moving towards being **learnin**g **centered** rather than being **content centered.**	1	2	3	4	5
18.	The **pathology teaching** in this Term II course enhances my **motivation to learn.**	1	2	3	4	5
19.	The **pathology teaching** in this Term II course encourages **student engagement in the classroom.**	1	2	3	4	5

Dr. Rani Kanthan ***07th May 2007***

APPENDIX 3.2 Student Questionnaire for PATH 201 at Midterm & Final Exams

		Strongly Disagree				Strongly Agree
20.	The **pathology teaching** in this course encourages more **active learning opportunities (in class questions, discussion, group activities).**	1	2	3	4	5
21.	The **pathology teaching** in this course encourages my **independent study.**	1	2	3	4	5
22.	The **pathology teaching** in this course encourages me to **reflect on how I am learning**.	1	2	3	4	5
23.	The **pathology teaching** in this course **provides me with opportunities for interpersonal learning activities.**	1	2	3	4	5
24.	The **pathology teaching** in this course promotes **me to reflect on the content material discussed.**	1	2	3	4	5
25.	**The pathology teaching** in this course **encourages me to question thing**s I hear in lectures.	1	2	3	4	5
26.	The **pathology teaching** in this course **e**ncourages me to relate ideas in one subject to those in another.	1	2	3	4	5
27.	The **pathology teaching** in this course encourages me to be **cautious in drawing conclusions** unless they are well supported by evidence.	1	2	3	4	5
28.	The **pathology teaching** in this course promotes rote memorization of important facts **(memorization by repetition without comprehension).**	1	2	3	4	5
29.	T**he pathology teaching** in this course as it is **not clearly structured.**	1	2	3	4	5
30.	**Integrated curriculum** design of this first year of medical school has facilitated the move from time **spent in formal classes to time spent in independent study.**	1	2	3	4	5
31.	**The pathology teaching** in this course provides me with an opportunity of the **choice in the work to be done for this course.**	1	2	3	4	5
32.	There are opportunities for teaching staff **to provide helpful feedback** in this **integrated curriculum.**	1	2	3	4	5
33.	The **pathology teaching** in this course uses a variety of **learning strategies** that work for me.	1	2	3	4	5
34.	**I am rarely bored** in this learning environment.	1	2	3	4	5
35.	The **pathology teaching** in this course **is well focused.**	1	2	3	4	5
36.	I feel the **pathology teaching** in this course is **preparing me well for my profession.**	1	2	3	4	5
37.	**I feel comfortabl**e in the classroom learning environment.	1	2	3	4	5
38.	The atmosphere is **relaxed** during the lectures in this course.	1	2	3	4	5
39.	The **contact teaching time** in this course is put to **good use.**	1	2	3	4	5
40.	I find the classroom **experience stimulating.**	1	2	3	4	5
41.	The **teaching of pathology** in this course **encourages** me to be an **active participant in my learning.**	1	2	3	4	5

APPENDIX 3.2 Student Questionnaire for PATH 201 at Midterm & Final Exams

		Strongly Disagree				Strongly Agree
42.	The **pathology teachings** in this course have shown me how much of what I learn today seems **relevant** to my future training for a career in healthcare.	1	2	3	4	5
43.	I i**nteract easily** with other students in my class.	1	2	3	4	5
44.	The **pathology teaching** in this course **has increased my stress load.**	1	2	3	4	5
45.	**Pathology teachings** in this course have strengthened my foundations by recognizing the interrelationships within and between the various disciplines.	1	2	3	4	5
46.	Overall I have **learned** with understanding a great deal in this course.	1	2	3	4	5
47.	I consider the pathology teachings in this course to be **valuable to** my future training for a career in healthcare.	1	2	3	4	5
48.	Overall I am satisfied with the **integrated structure of pathology teaching** as an independent stand alone course in Term II.	1	2	3	4	5

OPEN ENDED FREE RESPONSE QUESTIONS

Q1. What aspects of this COURSE have facilitated your learning with understanding?

Q.2.What aspects of this COURSE did you like the most?

Q.3.What aspects of this COURSE should be altered in the future?

Q.4. Any other comments or suggestions?

APPENDIX 3.3 Student Questionnaire for Path 302.9 (at the end of 3 systems).

THE SYSTEMIC PATHOLOGY COURSE 302.9 STUDENT QUESTIONNAIRE
END OF Term II-PHASE B/C 2nd Year medical Students

1=Strongly disagree; 2=Disagree; 3= Neutral; 4=Agree; 5= Strongly agree

Please circle the extent of your disagreement or agreement for each of the following statements.

		Strongly Disagree				Strongly Agree
1.	**The pathology teaching** in this course **facilitates my learning**.	1	2	3	4	5
2.	**The pathology teaching i**n this course helps me **understand concepts** of basic pathological processes in relation to their systemic context.	1	2	3	4	5
3.	**The pathology teaching** in this course helps me **understand** the continuum of pathological processes from the normal to the disease states.	1	2	3	4	5
4.	I am **satisfied w**ith the organizational structure of the **integrated approach of pathology teachin**g in this Systemic Pathology (**stand alone) course in Terms I, II & III (PHASE B/C)**	1	2	3	4	5
5.	The **pathology teaching** in this course enhances the **effectiveness of my study skills.**	1	2	3	4	5
6.	The organizational **structure of integrated pathology teaching** helps me **understand and solve the case-based questions** in the exams for this course.	1	2	3	4	5
7.	The **review and examination questions** for this course emphasize **application of knowledge** rather than simple recall of factual knowledge.	1	2	3	4	5
8.	Overall I am **satisfied** with the independent **integrated structure of pathology** teaching in this systemic pathology course.	1	2	3	4	5
9.	The **pathology teaching** in this course has **c**ontributed to my overall e**ducational growth and development.**	1	2	3	4	5
10.	The **pathology teaching** in this course enhances my **analytical thinking skills.**	1	2	3	4	5
11.	The **pathology teaching** in this course is an **efficient use of my class-time.**	1	2	3	4	5
12.	This **pathology teaching** in this course has contributed to the ***quality* of my learning** this term.	1	2	3	4	5
13.	The **goals and objectiv**es for this course are clearly stated.	1	2	3	4	5
14.	The examination questions are **matched to the goals and objectives of** this section in the course.	1	2	3	4	5
15.	The **learning climate** of the pathology teaching classroom is **positive.**	1	2	3	4	5
16.	I find the **workload r**elated to this course **stressful.**	1	2	3	4	5
17.	**The pathology teaching** in this course is **learnin**g **centered** rather than being **content centered.**	1	2	3	4	5
18.	The **integration of system**ic pathology to the teaching of systems **enhances my personal motivation to learn.**	1	2	3	4	5
19.	**The pathology teaching** in this course encourages **student engagement** in the classroom**.**	1	2	3	4	5

APPENDIX 3.3 Student Questionnaire for Path 302.9 (at the end of 3 systems).

		Strongly Disagree				Strongly Agree
20.	This **integration of systemic pathology** encourages **active learning opportunities (in class questions, discussion, group activities).**	1	2	3	4	5
21.	This **integration of systemic pathology** encourages me to study independently.	1	2	3	4	5
22.	This **integration of systemic pathology** encourages me to **reflect on how I am learning.**	1	2	3	4	5
23.	This **integration of systemic pathology** provides me with **opportunities for interpersonal learning activities.**	1	2	3	4	5
24.	This **integration of systemic pathology** encourages **reflection on the content material discussed.**	1	2	3	4	5
25.	This **integration of systemic pathology** encourages me to **question thing**s I hear in lectures.	1	2	3	4	5
26.	This **integration of systemic pathology e**ncourages me to **relate ideas in one subject to those in another.**	1	2	3	4	5
27.	This **integration of systemic pathology** encourages me to be **cautious in drawing conclusions** unless they are well supported by evidence.	1	2	3	4	5
28.	This **integration of systemic pathology** promotes **rote memorization** of important facts. **(memorization by repetition without comprehension)**	1	2	3	4	5
29.	This **integration of systemic pathology** is **not clearly structured.**	1	2	3	4	5
30.	This **integration of systemic pathology** has facilitated the move from time **spent in formal classes to time spent in independent study.**	1	2	3	4	5
31.	This **integration of systemic pathology** provides me with an opportunity of **the choice in the work to be done for this course.**	1	2	3	4	5
32.	There are op**portunities for teaching staff to provide helpful feedback** in this integrated systemic pathology course.	1	2	3	4	5
33.	This **integration of systemic pathology** uses a variety of **learning strategies** that work for me.	1	2	3	4	5
34.	**I am rarely bored** in this learning environment.	1	2	3	4	5
35.	The **pathology teaching** in this course **is well focused.**	1	2	3	4	5
36.	I feel the **pathology teaching** in this course is **preparing me well for my profession.**	1	2	3	4	5
37.	**I feel comfortabl**e in the classroom learning environment of this course.	1	2	3	4	5
38.	The atmosphere is **relaxed** during the lectures in this course.	1	2	3	4	5
39.	The **contact classroom teaching time** in this course is put to **good use.**	1	2	3	4	5
40.	I find the classroom **experience** in this course **stimulating.**	1	2	3	4	5
41.	The **teaching of pathology** in this course encourages me to be an **active participant in my own learning.**	1	2	3	4	5

APPENDIX 3.3 Student Questionnaire for Path 302.9 (at the end of 3 systems).

		Strongly Disagree				Strongly Agree
42.	This **integration of systemic pathology** has shown me how much of what I learn today seems **relevant** to my future training for a career in healthcare.	1	2	3	4	5
43.	I i**nteract easily** with other students in this course.	1	2	3	4	5
44.	The **pathology teaching** in this course **has increased my stress load.**	1	2	3	4	5
45.	**Pathology teachings in this course** help me to recognize the interrelationships within and between the various disciplines.	1	2	3	4	5
46.	Overall I have learned with understanding a great deal **in this course.**	1	2	3	4	5
47.	Last **years work** provides a **continuum---foundation for this years work.**	1	2	3	4	5
48.	I consider what I learned in this **course to be valuable** to my future training for a career in healthcare.	1	2	3	4	5
49.	Overall I am satisfied with the **integration of the teaching of systemic pathology with the teaching of systems.**	1	2	3	4	5

OPEN ENDED FREE RESPONSE QUESTIONS

Q1. What aspects of this COURSE have facilitated your learning with understanding?

Q.2.What aspects of this COURSE did you like the most?

Q.3.What aspects of this COURSE should be altered in the future?

Q.4. Any other comments or suggestions?

APPENDIX 3.4 Faculty/Medical Educator Questionnaire

Please circle your most favoured response to each individual question.

THE INTEGRATED PATHOLOGY TEACHING EXPERIENCE QUESTIONNAIRE

1=Strongly disagree; 2=Disagree; 3= Neutral; 4 Agree; 5= Strongly agree

1. The **organizational structure of an integrated curriculum facilitates my teaching skills.**
SD D N A SA

2. The **organizational structure of an integrated curriculum promotes increased student engagement.**
SD D N A SA

3. The **organizational structure of an integrated curriculum promotes increased student learning.**
SD D N A SA

4. The **organizational structure of an integrated curriculum promotes increased faculty interaction**s.
SD D N A SA

5. The **integrated curriculum has increased my workload.**
SD D N A SA

6. The **organizational structure of the integrated curriculum lacks direction / sense of purpose.**
SD D N A SA

7. The **organizational structure of the integrated curriculum lacks commitment.**
SD D N A SA

8. The **organizational structure of the integrated curriculum lacks motivation.**
SD D N A SA

9. The **integrated curriculum is well suited to the students' long term goals of being a physician.**
SD D N A SA

10. The **integrated curriculum has promoted increased student ownership of learning.**
SD D N A SA

11. The **integrated curriculu**m promotes better **understanding of the body as one whole functioning unit** rather than in compartmentalized forms and functions.
SD D N A SA

OPEN ENDED QUESTIONS

1. Any other suggestions or comments? Any observations?

APPENDIX 3.5 ETHICS PROPOSAL

APPLICATION FOR APPROVAL OF RESEARCH PROTOCOL IN MEDICAL EDUCATION

1. Name of researcher Dr. Rani Kanthan

1a. Name of Masters student Dr. Rani Kanthan

1.b. Name of Supervisors Dr Keith Walker and Dr Marcel D'eon

1b. Anticipated start date of the research study (phase) and the expected completion date of the study (phase).

01 January 2007 – 30th June 2007

2. Title of Study

"A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2007- May 2007."

3. INTRODUCTION / BACKGROUND TO THE STUDY

Medical educators readily acknowledge the double impact of a) ever increasing 'new' scientific information (content overload) coupled with b) 'new' intense technology driven tools on student learning and the quality of the learning experience (1-5). This has resulted in major paradigm shifts in undergraduate medical education that have lead to major revisions in curriculum program design and delivery (6, 7). At the College of Medicine, University Of Saskatchewan the overall redesigned curricular program will be phased in over the next four years of the curriculum with a greater emphasis towards an integrated approach of the teaching and learning of human disease. In the first year, this has led to the creation of a patchwork quilt teaching with a cross disciplinary functional system teaching style that incorporates elements of the traditional basic science components of anatomy, physiology, embryology, histology with an introduction of some core general pathological concepts.

The pedagogy of an integrated curriculum embraces many models of integration representing a continuum with full integration at one end to discipline –based teaching at the other, and many intermediate steps between the two extremes. A vertically integrated curriculum seeks to bridge the preclinical and clinical divide in content by teaching the content concurrently rather than sequentially retaining discipline boundaries, while a horizontally integrated curriculum seeks to further break down the distinction between the basic and clinical sciences within the early years of the program focusing on the basic sciences with added clinical features being introduced into the program wherever possible with a gradual shift to a more clinical focus taking place over time. Overall reference to the basic sciences and continued collaboration characterizes this latter approach (8,9)

4. PRIMARY OBJECTIVE

The main objective of this research is to investigate the advantages and disadvantages of the two models of horizontal and vertical integration of the teaching of pathology through an analysis of the perceptions of individual medical educators and Year 1 and Year 2 students in the undergraduate curriculum at the College of Medicine in Saskatoon based contextually within the theoretical framework of the newly designed medical curriculum.

Research Question

The overarching research question embraces and hopes to find answers to:

What are the advantages and disadvantages of the two models of horizontal and vertical integration of the teaching of pathology based a) within the existing theoretical framework of curricular integration and b) empirically through the perceptions of students and medical educators who participated in the undergraduate medical curriculum during Term II academic year January 2007- May 2007?

This basic question is explored through three specific research questions:

1) What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum within a theoretical framework of the existing medical literature on curricular integration?
2) What are the advantages and disadvantages of the two models of horizontal and vertical integration in the newly designed medical curriculum through the lens of the students and the lens of the faculty-medical educators as key participants in this study?
3) Does this model of integration enhance the learning environment by providing the continuum that help students to recognize and appreciate the value of the unique role of pathology and laboratory medicine as an underlying foundational scaffold to the diagnosis, pathogenesis and management of disease states

5. Funding - Not applicable

6. Expertise Not applicable.

7. Conflict of Interest

I am the Undergraduate course co-ordinator responsible overseeing the pathology teaching. PATH 201.3 (new Course) is horizontally integrated in Term II of the First Year addressing the core General pathology concepts. Some general pathology concepts such as inflammation, thromboembolism, infarction, and amyloidosis will be vertically introduced into the newly created Interdisciplinary functional systems course (ITDL 201.18) in YEAR 1.

PATH 302.9 has been horizontally integrated with the teaching of systems for 18 months over the PHASE B/C sessions. This was commenced in August 2006 for the Year 2 students. Thus Pathology will be represented as a continuum over YEARS 1, 2 and 3. These courses are mandatory for all students registered in the College of Medicine. The students of the College of Dentistry also attend the PATH 201.3 and the ITDL 201.18 as part of the undifferentiated curriculum of the first year students. I also participate as one of their instructors in these courses. These courses have multiple formative and summative

evaluations to determine the Final PASS or FAIL. There are no designated marks for transcripts. However assessment of the Pathology Prize for the highest Academic standing in each of the courses is determined by the overall percentage score obtained by the multiple evaluations. All students will PASS and if there are any borderline cases remedial course work is offered. I have been the Course Co-ordinator for 5years and have not failed or kept any student from being promoted due to their Pathology performance. I have no financial benefits from the research, and no monetary incentives for recruiting the participants or for conducting the research. The findings will however be shared at intercollegiate, national and international medical educator's forum and interesting facets will be prepared for publication.

8. Participants

The principal methodology proposed for this predominantly quantitative descriptive comparative study of the measurement of this educational situation (at the Post secondary level) will be mixed data collection that includes

A) Predominantly quantitative analysis of semi-structured survey questionnaires (Lickert Scales) for students and faculty (Appendix A1, A2, A3, A4) and student examination assessment outcomes. These tools are best suited in capturing the perceptions of a larger number of students and the smaller number of participating faculty. Open ended questions are also included in these questionnaires encouraging participants to share any further comments or suggestions. **These questionnaires will be administered during class time to ensure compliance and completion of the task. Questionnaires sent away with students never get returned as seen from past experiences. However, from past experiences students are more than happy to complete tasks as long as they are built within the designated contact hours of their curriculum and do not require any extra time within their busy schedules. After the initial introductions and brief explanations of the integration of pathology teaching I will leave the room so that students who do not wish to participate feel no perceived loss of identity. Designated personnel will be responsible for the final collection of all questionnaires in labeled boxes that will then be delivered to my office for detailed analysis.**

B) In the qualitative research inquiry, a focus group interview with the student participants at the end of each of the three modules will also be undertaken to further capture and explore any evolving trends. Using the responses to the preliminary semi-structured questionnaire the faculty (medical educators) participants will be interviewed for one hour through the key areas of integration and then open up the discussion through their experiences to produce theoretically informed accounts of their experiences with a critical analysis of the categories and forms through which they are experiencing the same (Appendix A5). The participants will also be encouraged and invited to share any self-reflections and comments or suggestions.

After obtaining ethics approval, I will purposive sample 6 faculty members who have thus far participated in the teaching of the newly integrated medical curriculum. Their participation in the study will be of their own free will (voluntary). The inclusion criteria for the participants are a) to be a current faculty member at the College of Medicine, University of Saskatchewan, b) to have participated in the teaching of the newly integrated undergraduate medical curriculum since its inception in August 2006.

The focus group interviews will be administered through the Education and Support Development Division of the College of Medicine under the guidance of the Director Dr Marcel D'Eon who is also my co-supervisor. Herewith is their assurance to do the same.

Our unit is called Educational Support and Development and yes, we will do the focus groups as you have outlined. We can select and contact the students then lead the focus group and provide anonymous data to you (all free!). At the time we will send the consent form to them so they know about it and when they come for the focus group we will ask them to sign and we will collect and keep them on file.

Cheers,

Marcel

I will receive the report generated from these interviews as data for analysis and interpretation. I will not be involved directly in these proceedings to avoid any possibility of position of power conflicts.

No recruitment materials, such as posters, advertisements or letters of invitation are being used for this study.

9. Consent

I, the researcher will meet with the participants (faculty/medical educator) individually to inform them about the research study and explain the consent to participate in this study. Participants will be informed about the expectations for the study. In addition, it will be explained to participants that they are free to withdraw at any time without any detrimental effect and if so, all their data collected thus far from questionnaires, interviews and observations will be destroyed.

Informed consent will be obtained from each participant who will be *read* the consent form and be given an opportunity for questions (APPENDIX B). The participants will sign and or accept the consent form to indicate their agreement to participate before the study proceeds. Voluntary anonymous completion of the questionnaires by the students in class will be accepted as proof of consent to participate in this study (APPENDIX D)

10. Methods/Procedures

This study will use comparative quantitative and qualitative research inquiry to learn about the advantages and /or disadvantages of the newly integrated medical curriculum through the voices of the faculty /medical educators and the students. As perceptions is not a fixed practice , I intend to use both semi-structured questionnaire (students and faculty participants) , focus group interviews (student participants) and in-depth conversational interviews (faculty participants) as data gathering tools with the key informants.(APPENDIX A1-5)

- Semi-structured interviews *(interviews in which the same general questions or topics are raised to each of the key informants)* give confidence of getting comparable data across participants using a list of general questions.
- In response to participants I will also use open-ended questions as a probe in order to gather a wide range of perspectives (in depth interviewing is designed to elicit a rich understanding of the participant's way of thinking. These interviews are less structured

than a typical interview and involve the researcher probing into topics that the participant may bring up).

- The semi-structured interview is the mode of choice when a researcher *knows what he or she doesn't know* and can therefore frame appropriate questions to find out, while the conversational interview is used to elicit discussion about opinions or values that the participant deems relevant or meaningful to the topic. Such conversational questioning alerts a researcher to aspects of their topic that otherwise may be overlooked.
- The interviews will be audio taped and transcribed. In keeping with respectful research, participants will have the opportunity to read the transcribed interviews for clarification and sign a Data Transcript Release (Appendix C). If quotes are used, the participants will have the opportunity to read what is said about their participation but identifying information will be excluded.
- Analysis will be ongoing as the researcher sifts through the data looking for patterns and connections using a constant comparative methodology. Through analytic induction, I will be able to infer that events or statements were instances of the same underlying theme all the while keeping the research question in focus.
- As a researcher, I will ask, "*Is this code similar to or different from other codes?"* A similar technique is used in looking for patterns between the codes and categories by using the researchers' insights and knowledge of the subject area.

- **Interpretation:** Intensive study of the summary of these patterns will be used in rendering the interpretation of this study which may require me, the researcher to think in new and dialogical ways. Interpretation involves redesigning old categories, formulating new relationships by combining elements in novel ways, projecting beyond what actually exits, and conjuring up probable connections. The current findings will be integrated with those of related and relevant studies, to a) establish how these results relate to broader theoretical frameworks b) to explicate what the study means outside of the one context, c) to serve as an in-service monitoring form of evaluation /assessment of the newly implemented curriculum d) to be aware of any major errors/dissatisfactions and e) be able to make recommendations and suggestions regarding these observations to the Undergraduate Curriculum Committee of the College of Medicine at the University of Saskatchewan.

11. Storage of Data

Upon the completion of the study, all data (field notes, transcripts, and tapes will be securely stored and retained by the researcher Dr. Rani Kanthan for a minimum of five years in the Department of Curriculum Studies, College of Education in accordance with the University of Saskatchewan guidelines – *approved by University Council, December 8, 1993; revised February 21, 1994.*) before being destroyed.

[The principal investigator or co-investigator and/or student/faculty shall be able to verify the authenticity of all data, or other factual information, generated in this research, while ensuring that confidentiality is protected where required. Such material will not be destroyed while there is a reasonable probability of questions from other investigators, colleagues or readers of resulting publications which could require access to primary data or may require a re-analysis of the data.]

12. Dissemination of Results

Participants will be informed that their contributions (which they agree to share in the Data/Transcript Release Form, Appendix C) may serve as a pilot study for further research in this area. Interpretations of this study will be used by me for presentations as required. Written reports and publications may be generated based on the research and findings of this study.

- In keeping with the collaborative nature of this research, the participants will have the opportunity to read their contributions to the draft of the study and make comments. At the end of the study, participants will be given the opportunity to obtain a copy of the written report and or published manuscript as the case maybe. The data collected may also be shared among other medical educators at conferences, meetings and as publications in appropriate journals.

13. Risk, Benefits, and Deception

There is no risk or deception in the study. Participants will be made aware of the purpose of the study and why they are participants. It is not anticipated that any of the questions will be of an uncomfortable nature. The study will be minimal risk and will be conducted after an Informed Consent is obtained from the Participants (APPENDIX B,D)

The potential benefits of the research include active student involvement in the structural design of the pathology course with student feed back and input into the evolving changes with redesign and realignment of the undergraduate medical curriculum.

There are no aspects of this study that involve risk or any harm that may arise as a result of participation. No deception is being used.

I am not studying a vulnerable, captive or dependent population, such as children or prisoners.

There is a power relationship between researcher and student participants as I am their teacher, though as I explained previously these courses are all mandatory: all will be admitted and they are PASS/FAIL courses and they will all PASS. These research instruments are mainly devised to improve course construction, course delivery and student learning environment with active student input. It is not the intent to have any specific information in my data file to link with specific participants.

Third parties will not be exposed to loss of confidentiality/ anonymity.
Videotaping is not being used in this study.
Participants will not be actively deceived or misled.
The research procedures are not likely to cause any degree of discomfort, fatigue, or stress.
Participants will not be asked questions that are personal or sensitive. Questions that might be upsetting to the respondent are unlikely.

The research procedures are not likely to induce embarrassment, humiliation, lowered self-esteem, guilt, conflict, anger, distress, or any other negative emotional state.

There is no social risk (e.g., possible loss of status, privacy or reputation)

The research will not infringe on the rights of participants by, for example, withholding beneficial treatment in control groups or restricting access to education or treatment.

Participants will not receive compensation of any type.

I can think of no possible harm that participants might experience as a result of participating in this study.

14. <u>Confidentiality</u>

- The study will take place in the working environment of the participants so there will be no loss of anonymity. Participants will be made aware what voluntary participation means. All participants will be assured that third party privacy (confidentiality) will be maintained throughout the gathering of information and the writing of the report.
- Pseudonyms will be used to identify participants and any identifying personal information about them or their attributes will not be used in any data report generated for verbal or written presentations.

  Participants will retain confidentiality and anonymity and third party privacy. In situations where it is necessary to link identifying information for a participant, this data link will be destroyed upon completion of data analysis. Only aggregate results are reported and all data will remain non-identifiable.

15. Withdrawal

All participants will be informed that they are free to withdraw at any time or they may choose to not answer particular questions. If a participant withdraws from the study they will be informed that it will be without penalty or loss of services and all collected data will be destroyed.

16. Data/Transcript Release

- Since the interview records opinions, feelings, recollections, and descriptions the participants (faculty/medical educator) will have the opportunity to read the transcripts to clarify add or delete information so that it will accurately represent them and their intellectual property.
- In keeping with respectful research, they will be told orally what the researcher would like to share about what they said and later they can read/edit what is *written in the draft* of the report generated.

17. Debriefing and feedback

Since this study is collaborative, the faculty participants will be involved throughout the study as they review their transcripts and their contribution to the draft of the study to feel reassured that the researcher is accurately interpreting and representing their intellectual property, that is their thoughts, feelings, and knowledge about their professional practice.

The participants will receive a copy of the study report generated.

The participants receive feedback from the results of the research and any published data will be available to the participants once the study has ended through PUBMED and other such search engines freely on the internet.

18. Required Signatures

This Research Proposal has been reviewed by:

Dr. Rani Kanthan (student researcher)

Supervisor:Dr.Keith Walker, Professor, Educational Administration, College of Education

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Co-supervisor: Dr. Marcel D'eon , Ediucational Support and Development , College of Medicine

19. Contact Name and Information

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APPENDIX A-1 (Draft)

(This questionnaire will be administered in class time by myself to the first year students. I will have a brief introduction regarding the nature of my research study and will explain the overarching framework of integrated curriculum and the broad concepts of vertical and horizontal integration that has been undertaken in the organizational structure in the teaching of pathology. It is estimated that approximately 20 minutes will be required for the completion of the same. As the students are the same cohorts as those attending the Path 201 –Appendix A-2 they will be familiar with the procedure and execution of this task. They will be requested to complete the questionnaire and drop it into the labelled boxes available at the end of the room. Once I have done the introductions and explanations I will leave the room and there will be designated personnel who will oversee the final collection of all the completed forms.)

Please circle your most favoured response to each individual question.

Questionnaire for year 1 Students –Medical and dental –Module 7, 10, 12 ITDL MEDICAL ☐
DENTAL ☐

THE INTEGRATED PATHOLOGY TEACHING EXPERIENCE QUESTIONNAIRE

1=Strongly disagree; 2=Disagree; 3= Neutral; 4 Agree; 5= Strongly agree

1. **Pathology teaching** in the ITDL course has **increased the quality of my learning.**
SD D N A SA

2. The **introduction of pathology teaching in the ITDL cours**e helps me **better understand concepts** of basic pathological processes in relation to their physiological and anatomical basis.
SD D N A SA

3. The **integration of pathology teaching** in the ITDL Course helps me **construct increased meaning** into the link of pathological processes from the normal to the disease states.
SD D N A SA

4. I am **satisfied** with the organizational structure of the **integration of pathology teaching** in the ITDL course.
SD D N A SA

5. The **organizational structure of integration of patholog**y teaching helped me to **better understand and problem solve** the case based questions on the summative end of module exams in the ITDL course.
SD D N A SA

6. The **Assessment** tools for the pathology teaching emphasized application of knowledge rather than simple recall of factual knowledge.
SD D N A SA

7. Overall I learned and understood a great deal **in this module.**
SD D N A SA

8. I consider what I learned in this module **valuable and relevant** for my future training.
SD D N A SA

9. Overall I am satisfied with the **organizational structure** of pathology teaching in this modular unit.
SD D N A SA

10. This organizational **structure of pathology teaching** contributed to my overall **educational growth** and development.
SD D N A SA

11. This **organizational structure** of pathology teaching contributed to promoting **effective study skills.**
SD D N A SA

12. The **integration of pathology teaching** has facilitated my **analytical thinking skills**.
SD D N A SA

13. The **integration of pathology teaching** is an **efficient use of the student contact hours** in this module.
SD D N A SA

14. This **integration of pathology** teaching has contributed to the ***quality* of my learning.**
SD D N A SA

15. There were **clear goals and objectives f**or the pathology section in this module.
SD D N A SA

16. The **multiple assessment tools** used to assign "PASS/ FAIL" were matched to the **goals and objectives of this** module.
SD D N A SA

17. The **social climate** of the classroom is **positive.**
SD D N A SA

18. I found the **workload r**elated to the pathology component to be **stressful.**
SD D N A SA

19. **Integrated pathology curriculum** is moving towards being **student-centered learnin**g **oriented** rather than being **teacher-centered content oriented.**
SD D N A SA

20. The **integration of pathology teaching** within this module enhanced my **motivation to learn.**
SD D N A SA

21. The **integration of pathology** teaching within this module **increased student engagement** in the classroom.
SD D N A SA

22. **Integration of the curriculum a**s in ITDL Course has encouraged **more active learning opportunities.**
SD D N A SA

23. **Integration of the curriculum** as in the ITDL course has encouraged **my individual self learning.**
SD D N A SA

24. **Integration in the ITDL course** has provided more opportunities for **interpersonal learning activities.**
SD D N A SA

25. **Integrated curriculum a**s the ITDL course has promoted **personal self reflection related to my learning.**
SD D N A SA

26. **Integration of the curriculum** as in ITDL has promoted **personal self reflection related to the subject content.**
SD D N A SA

27. **Integration of the curriculum** as in ITDL has **encouraged me to question thing**s I hear in lectures.
SD D N A SA

28. **Integrated curriculum a**s in ITDL **encourages me to relate ideas in one subject to those in another.**
SD D N A SA

29. **Integrated curriculum** as in ITDL has **encouraged me to be cautious in drawing conclusion**s unless they are well supported by evidence.
SD D N A SA

30. **Integrated curriculum** as in ITDL **promotes rote memorization of important facts**.
SD D N A SA

31. **This integrated curriculum as** in ITDL is **not clearly structured or organized.**
SD D N A SA

32. **Integrated curriculum** as in ITDL has facilitated the move **from time spent in formal classes to time spent in independent study.**
SD D N A SA

33. **Integrated curriculum** as in ITDL has provided an opportunity of **increased choice in the work to be don**e.
SD D N A SA

34. There are more op**portunities for teaching staff to provide helpful feedback** in this integrated curriculum.
SD D N A SA

35**. The integrated curriculum** as in ITDL uses a **variety of learning strategies that work for me.**
SD D N A SA

36. **I am rarely bored** in this learning environment.
SD D N A SA

37. **The teaching** in the integrated curriculum is **well focused**.
SD D N A SA

38. I feel **the integrated curriculum** as in ITDL is **preparing me well** for my profession.
SD D N A SA

39. **I feel comfortabl**e in class **socially.**
SD D N A SA

40. The atmosphere is **relaxed** during the lectures in the integrated curriculum.
SD D N A SA

41. The **contact teaching time in the integrated curriculu**m in ITDL is put to **good use.**
SD D N A SA

42. I find the classroom **experience stimulating.**
SD D N A SA

43. The **teaching encourage**s me to be an **active learner.**
SD D N A SA

44. **The integrated curriculum** as in ITDL has **shown me** how much of what I learn today seems **relevant to a career in healthcare.**
SD D N A SA

45. **Integrated teaching** has facilitated me to **interact easily** with other students in my class on a regular basis.
SD D N A SA

46. I find the **integrated curriculum** has **increased my stress load**.
SD D N A SA

47. I find a **systematic progression of my classes** with **increase to my basic knowledge pool.**
SD D N A SA

48. Overall I am satisfied with the **quality of pathology teaching** in this modular unit.
SD D N A SA

OPEN ENDED FREE RESPONSE QUESTIONS

1. What aspects of this module facilitated to your greater understanding and learning?

2. What aspects of this module can be altered in the future?

3. What aspects of this module did you like the most?

4. Any other comments or suggestions?

APPENDIX A-2(Draft)

[Students enrolled in this course have already access to the general course objectives (enclosed as APPENDIX A-2a) that outlines the general trends of integration and changes in the organizational structure teaching of pathology. There is also a heads up regarding the questionnaires and surveys that they will be participating and this will be explained on the first day of class –January 03rd as part of the Introductions. This questionnaire will be administered in class time by myself to the first year students in this course after the Midterm Exam and Final Exams. I will have a brief introduction regarding the nature of my research study and will explain the overarching framework of integrated curriculum and the broad concepts of vertical and horizontal integration that has been undertaken in the organizational structure in the teaching of pathology. It is estimated that approximately 20 minutes will be required for the completion of the same. They will be requested to complete the questionnaire and drop it into the labelled boxes available at the end of the room. Once I have done the introductions and explanations I will leave the room and there will be designated personnel who will oversee the final collection of all the completed forms.

Please circle your most favoured response to each individual question.

Questionnaire for year 1 Students –Medical and dental –Path 201.3 MEDICAL ☐ DENTAL ☐

THE INTEGRATED PATHOLOGY TEACHING EXPERIENCE QUESTIONNAIRE

1=Strongly disagree; 2=Disagree; 3=Neutral; 4 Agree; 5= Strongly agree

1. **Pathology teaching** in this Pathology course has **increased the quality of my learning**.
SD D N A SA

2. **Pathology teaching i**n this Pathology course helps me **understand concepts** of basic pathological processes in relation to their physiological and anatomical basis.
SD D N A SA

3**. Pathology teaching** in the Path Course helps me **construct meaning** into the link of pathological processes from the normal to the disease states.
SD D N A SA

4. I am **satisfied w**ith the organizational structure of the **integrated approach of pathology teachin**g in the Pathology **stand alone course in Term II.**
SD D N A SA

5. Overall I **learned** and understood a **great deal in this course.**
SD D N A SA

6. I consider what I **learned in thi**s course is **valuable and relevant** for my future training.
SD D N A SA

7. Overall I am **satisfied** with the **integrated structure of pathology** teaching in this course.
SD D N A SA

8. The organizational **structure of integrated pathology teaching** helped me **better understand and solve the case** based questions on the summative midterm and final exams in the Path course 201.3
SD D N A SA

9. The **Assessment** tools for the pathology teaching emphasized **application of knowledge** rather than simple recall of factual knowledge.

SD D N A SA

10. This **organizational structure of pathology teaching c**ontributed to my overall e**ducational growth and development.**

SD D N A SA

11. This **organizational structure of pathology teach**ing contributed to promoting effective study skills.

SD D N A SA

12. The **integration of pathology** has facilitated my **logical analytical thinking skills.**

SD D N A SA

13. The **integration of pathology** is an **efficient utilization of the student contact hours** in this course.

SD D N A SA

14. This **integration of pathology** has contributed to the ***quality* of my learning.**

SD D N A SA

15. There were **clear goals and objectiv**es for the pathology section in this course.

SD D N A SA

16. The multiple **assessment tools** used to assign "PASS/ FAIL" were **matched to the goals and objectives of** this course.

SD D N A SA

17. The **social climate** of the classroom is **positive.**

SD D N A SA

18. I **found the workload** related to this course **stressful.**

SD D **N** A SA

19. **Integrated curriculum** is moving towards **student centered learning oriented** rather than **teacher centered content oriented.**

SD D N A SA

20. The **integration of general pathology** in this Term II enhanced my **motivation to learn.**

SD D N A SA

21. The **integration of general pathology** in this Term II enhanced **student engagement in the classroom.**

SD D **N A SA**

22. The **integration of the curriculum** has encouraged more **active learning opportunities.**

SD D N A SA

23. **Integration of the curriculu**m has encouraged my **individual self learning.**

SD D N A SA

24. **Integration has p**rovided **more opportunities for interpersonal learning activities.**

SD D N A SA

25. **Integration of the curriculum** has promoted **personal self reflection related to my learning.**

SD D N A SA

26. **Integration of the curriculum** has promoted **personal self reflection related to the subject content.**
SD D N A SA

27. **Integrated curriculum e**ncourages me to relate ideas in one subject to those in another.
SD D N A SA

28. **Integrated curriculum** has encouraged me to be **cautious in drawing conclusions** unless they are well supported by evidence.
SD D N A SA

29. **Integrated curriculum** promotes rote memorization of important facts.
SD D N A SA

30. I **do not like this integrated curriculum** as it is **not clearly structured.**
SD D N A SA

31**. Integrated curriculum** has facilitated the move from time **spent in formal classes to time spent in independent study.**
SD D N A SA

32. **Integrated curriculum** has provided an opportunity of **increased choice in the work to be done.**
SD D N A SA

33. There are **more opportunities for teaching staff to provide helpful feedback in this integrated curriculum.**
SD D N A SA

34. The **integrated curriculum** uses a variety of **learning strategies** that work for me.
SD D N A SA

35. I **am rarely bored in this learning environment.**
SD D N A SA

36. The **teaching in the integrated curriculum is well focused.**
SD D N A SA

37. I feel the **integrated curriculum** is **preparing me well for my profession.**
SD D N A SA

38. I **feel comfortable in class socially.**
SD D N A SA

39. The **atmosphere is relaxed during the lectures in the integrated curriculum.**
SD D N A SA

40. The **contact teaching time in the integrated curriculum is put to good use.**
SD D N A SA

41. I find the **classroom experience stimulating.**
SD D N A SA

42. The **teaching encourages me to be an active learner.**
SD D N A SA

43. The **integrated curriculum** has shown me how much of what I learn today seems **relevant to a career in healthcare.**
SD D N A SA

44. I i**nteract easily with other students in my class on a regular basis.**
SD D N A SA

45.I find the **integrated curriculum has increased my stress load.**
SD D N A SA

46.I find a **systematic progression of my classes with increase to my knowledge POOL.**
SD D N A SA

47. Overall I am **satisfied** with the **quality o**f pathology teaching in this course.
SD D N A SA

OPEN ENDED FREE RESPONSE QUESTIONS

1. What aspects of this **COURSE** facilitated to your greater understanding and learning?

2. What aspects of this **COURSE** can be altered in the future?

3. What aspects of this **COURSE** did you like the most?

4. Any other comments? OR suggestions?

APPENDIX – A 2a

Course Title: General Pathology- Addressed in
(Vertically Integrated Components in the ITDL Modules +
Horizontally integrated component –This course)

Path 201.2 –TERM 2 PHASE A
Wednesday 8:30- 9:30 A.M.
January 2007-May 2007

Coordinator: Dr. R. Kanthan

Instructional Hours: 13 hours

General Course Objectives

This course is an overview of the general pathological conditions and principles common to underlying systemic afflictions of the body as applicable to the real life practices of medicine and dentistry. The role of the laboratory in the day to day clinical diagnosis and management of patients in relation to systemic and oral pathologies will be explored.

The students will continue to acquire fundamental knowledge and understand concepts of the basic pathological processes both within the given frame work of vertical integration within functional modular systems in ITDL 206 (Example – general pathological concepts integrated in the modules of cardiovascular, defense, nutrient transport and interacting systems- Modules 5, 7, 10, 14) and within a horizontal integration framework of this stand alone course of approximately 13 contact hours.

Rationale

The proposed revisions of the curriculum continue to be on a system based functional approach, rather than disease based or organ based curricula. This curricula change leading towards an integrated curriculum will facilitate the teaching of system pathology with the teaching of systems for the following years and promote the understanding of the utilization of the laboratory in the future daily practice of medicine and dentistry. In this context, comprehension of pathogenetic mechanisms that underlie systemic diseases as applicable to the real life practices of medicine and dentistry in year 1 will provide an understanding and rationalization of clinical diagnosis, therapy and management in the following years 2 and 3.
Pathological concepts are the fundamental scaffolding blocks upon which all diseases are fundamentally diagnosed and treated. It is hoped that this model of integration will enhance the learning environment by providing the continuum that help students to recognize and appreciate the value of the unique role of pathology and laboratory medicine as an underlying foundational scaffold to the diagnosis, pathogenesis and management of disease states.

Course content

This course is based on the content material of chapters 1-9 of the required text book, Kumar V, Cotran R, and Robbins S. (2003) Basic Pathology (7th Edition). Philadelphia, PN: Saunders. ISBN 0-7216-9274-5. The course content includes the introduction of the basic concepts such as those related to: introduction of the laboratory and the role of the Pathologist - to the pathology specimen - to the clinical tests - the role of autopsy in clinical management; understanding appropriate utilization of laboratory tests - understanding the basis and appropriate utilization of liver function tests with relevance to the clinical evaluation of jaundice; cellular injury and cell death, cellular accumulations, amyloidosis, acute and chronic inflammation, repair regeneration and fibrosis, hemorrhage and thrombosis, embolism and infarction, edema, shock, atherosclerosis, environmental pathology including obesity, occupational hazards including pneumoconiosis and fundamentals of neoplasia.

Instructional methods

Students will be engaged actively in a variety of instructional experiences that will help interweave the threads of understanding which link the pathology of diseases through multiple disciplines. These instructional strategies will include formal lecture sessions, active learning strategies such as in class group discussions, in class group jig saws, cooperative learning tasks, pre-assigned reading assignments, in class case explorations and discussions.

As a course co-coordinator my personal Philosophy on Teaching and Learning is echoed by those of Tsunesaburo Makiguchi Educator and author:

"The essence of education is not to transfer knowledge; it is to guide the learning process, to put responsibility for study into the students own hands. It is not the piecemeal merchandising of information; it is the bestowal of keys that allow people to unlock the vault of knowledge on their own. It does not consist of pilfering the intellectual property amassed by others through no additional effort of ones own; it would rather place people on their own path of discovery and invention."

In this course, you will be exposed to a variety of educational experiences and will also be asked to reflect on their values to you. I am personally greatly interested in the process of learning and strive to improve teaching strategies to address many of these values. This course in not just about content:-but on the process of instruction and its delivery-the facilitation of the learning environment; -it is our working together in the given framework of a large class - in understanding and learning this content not just individually but together with our peers as a whole.

Student Evaluation

Formative feedback will be provided to the students through a variety of methods including impromptu quizzes, peer feedback on class projects, self directed reading assignments that are handed in and receive written feedback, debate forum discussion, jigsaw reviews and question development and other interactive class activities that are aimed to enhance the learning environment and promote student engagement with a focus of being a student centered learning oriented course rather than teacher centered content oriented course.

Summative evaluation will include a midterm and final examination. The weight age of the marks and duration for these examinations will be negotiated with discussion by the students. The proposed format is a 2 hour examination for the midterm and the final examination. The midterm marks count towards 50 % of the final grade. The final Exam will be a comprehensive examination including up to 30% of the pre-midterm content being tested in an integrated case based scenario questions. The examinations will be of mixed format including multiple choice questions (MCQ's and short answer questions (SAQ's).

This course falls under the college mandate of PASS/FAIL. An overall assessment of the student performance in the entire course will therefore be graded using the above mentioned multiple formative and summative evaluations.

In my course all of you on this Day 1 are awarded an A.

For the rest of the entire course it is up to you to keep this A through all the exercises, assignments, exams, quizzes, class projects, debates, reviews etc.

You will also be asked to actively participate voluntarily in filling surveys and questionnaires that are part of my research study in helping me to develop evidence based best practice integration plan for the curricular instructional design of the teaching of pathology within an integrated curriculum. I sincerely look forward to receiving and analyzing all your perceptions of this new approach to the delivery of pathology teaching within the framework of vertical and horizontal integration of pathology and the multiple disciplines in medicine and dentistry.

BEST OF LUCK.

Resources

Course coordinator Dr. R. Kanthan (tel 655 2158/office Room 2868 "G Wing" Royal University Hospital, 103 Hospital Drive. Email:rani.kanthan@saskatoonhealthregion.ca)

Instructors Dr. Kanthan, Dr. Kalra, Dr. Qualtiere and Dr. Saxena.

The Department of Pathology and Laboratory medicine has a long-term vision of a firm commitment towards active teaching throughout the medical curriculum promoting active engagement with a student centered learning approach rather than a teacher centered content driven approach.

PAWS is one of your resources. You can retrieve lecture notes, case discussions, class schedules, engagements, and other such relevant information from PAWS. As a course co-coordinator I will use PAWS as our principal means of communication.

Required text
Kumar, V., Cotran, R., & Robbins, S. (2003) ***Basic Pathology*** (7th Edition). Philadelphia, PN: Saunders. ISBN 0-7216-9274-5

This is the required text for Systemic pathology in **Years 2 and 3** in **PHASE B/C** as well.

General Pathology 201
First Year Medical and Dental Students
(Wednesdays) 8:30 – 9:30 a.m.
January 3 – April 25, 2007
Room B6 – Health Science Building

COURSE CALENDAR

DATE	TOPIC	LECTURER
Wednesday, January 3, 2007	Welcome &Introductions -Untold saga of a pathology specimen (AP)	Dr. R. Kanthan
Wednesday, January 10, 2007	Clinical laboratory - the role of the clinical pathologist (CP)	Dr. J. Kalra
Wednesday, January 17, 2007	Autopsy, myths and realities	Dr. R. Kanthan
Wednesday, January 24, 2007	Cellular injury – cell death – necrosis, apoptosis	Dr. R. Kanthan
Wednesday, January 31, 2007	Cellular adaptations cellular accumulations	Dr. R. Kanthan
Wednesday, February 7, 2007	Amyloidosis	Dr. R. Kanthan
WEDNESDAY, FEBRUARY 12-18, 2007 – BREAK – NO CLASSES		
Wednesday, February 21, 2007	Environmental pathology & obesity – Part I	Dr. R. Kanthan
Wednesday, February 28, 2007	Environmental pathology – Part II	Dr. R. Kanthan
Wednesday, March 7, 2007	Self vs non-self **(Module 10 ITDL 206)**	Dr. L. Qualtiere
Wednesday, March 14, 2007	Hypersensitivity **(Module 10 ITDL 206)**	Dr. L. Qualtiere
Wednesday, March 21, 2007	Tissue repair: cell regeneration and fibrosis	Dr. R. Kanthan
Wednesday, March 28, 2007	**MID-TERM EXAMINATION**	
Wednesday, April 4, 2007	Neoplasia 1	Dr. A. Saxena
Wednesday, April 11, 2007	Neoplasia 2	Dr. A. Saxena
Wednesday, April 18, 2007	Neoplasia 3	Dr. A. Saxena
Wednesday, April 25, 2007	Neoplasia 4	Dr. A. Saxena

APPENDIX A-3----Second Year Medical students.-Systemic Pathology (Draft)

This questionnaire will be administered in class time by myself to the second year students. I will have a brief introduction regarding the nature of my research study and will explain the overarching framework of integrated curriculum and the broad concepts of vertical and horizontal integration that has been undertaken in the organizational structure in the teaching of pathology. It is estimated that approximately 20 minutes will be required for the completion of the same. They will be requested to complete the questionnaire and drop it into the labelled boxes available at the end of the room. Once I have done the introductions and explanations I will leave the room and there will be designated personnel who will oversee the final collection of all the completed forms.

Please circle your most favoured response to each individual question.

THE INTEGRATED PATHOLOGY TEACHING EXPERIENCE QUESTIONNAIRE

1=Strongly disagree; 2=Disagree; 3= Neutral; 4 Agree; 5= Strongly agree

1. The **organizational structure of the integrated pathology teachin**g to the systems teaching helped me **understand and solve the cas**e based questions on the summative exams in the Path course 302.9.
SD D N A SA

2. The **Assessment tools** for the pathology teaching emphasized **application of knowledge rather than simple recall** of factual knowledge.
SD D N A SA

3. Overall **I understoo**d a **great deal in** this course.
SD D N A SA

4. I consider what I **learned** in this course **valuable and relevant for my** future training.
SD D N A SA

5. Overall I am **satisfied with** the **structure an**d of pathology teaching in this course.
SD D N A SA

6. This **organizational structure of pathology teachin**g contributed to my **overall educational growth an**d development.
SD D N A SA

7. This **organizational structure of pathology teaching** contributed to promote effective study skills.
SD D N A SA

8. The **integration of pathology** has facilitated my **analytically .thinking** skills.
SD D N A SA

9. The **integration of pathology** is an efficient use of the **student contact hours** in this course.
SD D N A SA

10. This **integration of pathology** contributed to the ***quality* of my learning.**
SD D N A SA

11. There were **clear goals and objectives** for the pathology section in these systems.
SD D N A SA

12. The **multiple assessment tools** used to assign "PASS/ FAIL" were **matched to the goals and objectives** of this course.

SD D N A SA

13 The **social climate of the classroom is positive.**

SD **D** N A SA

14. I found the **workload** related to this course **stressful.**

SD D N A SA

15. **Integrated curriculum** is moving towards **student centered learning oriented** rather than **teacher centered content oriented.**

SD D N A SA

16. The **integration of system**ic pathology to the teaching of systems **enhanced my motivation to learn.**

SD D N A SA

17. This **integration of systemic pathology** has **increased student engagement** in the classroom.

SD D N A SA

18. **Integration of the curriculum h**as encouraged more **active learning opportunities.**

SD D N A SA

19. **Integration of the curriculum** has encouraged my **individual self learning.**

SD D N A SA

20. **Integration h**as provided **more o**pportunities for **interpersonal learning activitie**s.

SD D N A SA

21. **Integration of the curriculum** has promoted **personal self reflection related to my learning.**

SD D N A SA

22. **Integration of the curriculum** has promoted **personal self reflection related to the subject content.**

SD D N A SA

23. I**ntegrated curriculum** encourages me to **relate ideas in one subject to those in another.**

SD D N A SA

24. I**ntegrated curriculum** has encouraged me to be **cautious in drawing conclusions unless they are well supported by evidence.**

SD D **N** **A** **SA**

25. Integrated curriculum promotes rote memorization of important facts.

SD D N A SA

26. This **integrated curricul**um is **not clearly structured.**

SD D N A SA

27. **Integrated curriculum** has facilitated the move from **time spent in formal classes to time spent in independent study.**

SD D N A SA

28. **Integrated curriculum** has provided an **opportunity of increased choice in the work to be done.**

SD D N A SA

29. There are **more opportunities for teaching staff to provide helpful feedback in this integrated curriculum.**
SD D N A SA

30. Last **years work** provides a **continuum for this years work.**
SD D N A SA

31. The **integrated curriculum** uses a variety of l**earning strategies that work for me.**
SD D N A SA

32. I **am rarely bored in this learning environment.**
SD D N A SA

33. The teaching in the integrated curriculum **is well focused.**
SD D N A SA

34. I feel the **integrated curriculum** is **preparing me well for m**y profession.
SD D N A SA

35 . **I feel comforta**ble in class s**ocially.**
SD D N A SA

36. The **atmosphere is relaxed during the lectures in the integrated curriculum.**
SD D N A SA

37. The **contact teaching time in the integrated curriculum is put to good use.**
SD D N A SA

38. I **find the classroom experience stimulating.**
SD D N A SA

39. The **teaching encourages me to be an active lear**ner.
SD D N A SA

40. The **integrated curriculum** has shown me how much of what **I learn today seems relevant to a career in healthcare.**
SD D N A SA

41. I **interact easily with other students in my class on a regular basis.**
SD D N A SA

42. I find the **integrated curriculum has increased my stress load.**
SD D N A SA

43. I find a **systematic progression of my classes with increase to my knowledge base.**
SD D N A SA

44. Overall I understood a **great deal in** this course.
SD D N A SA

45. Overall I am **satisfied with** the **quality of** pathology teaching in this course.
SD D N A SA

OPEN ENDED FREE RESPONSE QUESTIONS

1. What aspects of this systemic pathology teaching facilitated to your greater understanding and learning?

2. What aspects of this Course can be altered in the future?

3. What aspects of this course did you like the most?

4. Any other comments? Or suggestions?

APPENDIX A-4 ---Faculty-Medical Educator Questionnaire (DRAFT)

This questionnaire will be provided to the faculty educators ahead of time for self analysis and to increase familiarity of the topics to be explored at the semi-structured interview.

Please circle your most favoured response to each individual question.

THE INTEGRATED PATHOLOGY TEACHING EXPERIENCE QUESTIONNAIRE

1=Strongly disagree; 2=Disagree; 3= Neutral; 4 Agree; 5= Strongly agree

1. The **organizational structure of an integrated curriculum facilitates my teaching skills.**
SD D N A SA

2. The **organizational structure of an integrated curriculum promotes increased student engagement.**
SD D N A SA

3. The **organizational structure of an integrated curriculum promotes increased student learning.**
SD D N A SA

4. The **organizational structure of an integrated curriculum promotes increased faculty interaction**s.
SD D N A SA

5. The **integrated curriculum has increased my workload.**
SD D N A SA

6. The **organizational structure of the integrated curriculum lacks direction / sense of purpose.**
SD D N A SA

7. The **organizational structure of the integrated curriculum lacks commitment.**
SD D N A SA

8. The **organizational structure of the integrated curriculum lacks motivation.**
SD D N A SA

9. The **integrated curriculum is well suited to the students' long term goals of being a physician.**
SD D N A SA

10. The **integrated curriculum has promoted increased student ownership of learning.**
SD D N A SA

11. The **integrated curriculu**m promotes better **understanding of the body as one whole functioning unit**. Rather than in compartmentalized forms and functions.
SD D N A SA

OPEN ENDED QUESTIONS

1. Any other suggestions or comments? Any observations?

APPENDIX A-5: SAMPLE QUESTIONS FOR INTERVIEWS -

***Note: Sample Questions will be framed in language that is clear to participants with special refrain from the usage of unfamiliar terminology.**

INTEGRATED CURRICULUM

(Research Question #1- What is curricular integration of pathology –faculty perceptions

Research Questions #2 – What are the advantages and disadvantages of the horizontal versus vertical integration-faculty perceptions?).

- What is your understanding of an integrated curriculum?
- Can you describe some of the types of integration that you are aware of?
- Can you explain what may be some of the advantages of the current integrated model of undergraduate education?
- What are some of the pitfalls /disadvantages of the current integrated model of undergraduate education that you foresee?
- In what ways is this integrated curriculum different from the traditional curriculum?

LEARNING ENVIRONMENT

(Research Question #3 – what is the effect of integration on student learning environment?)

- What are your impressions with regard to the current students learning environment?
- What changes do you appreciate in the current learning environment of students?
- How does the current integrated curriculum contribute/affect the learning environment of students?

APPENDIX B : LETTER OF CONSENT FOR FACULTY/MEDICAL EDUCATORS /PARTICIPANTS

Thank you for agreeing to be a participant in the mini-research study entitled ***"A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2007- May 2007."***

The purpose of this study is to monitor the newly implemented integrated curriculum through the lens of the medical educator. In order to protect the interests of the participants I will adhere to the following guidelines

1. I, the researcher will observe/interview 6 faculty / medical educators to discuss their perceptions of the advantages and disadvantages they have observed with the newly implemented first year integrated medical curriculum.

2. You will be interviewed for approximately one hour and each interview will be audio-recorded. I, acknowledge that you can withdraw at any time during the study without penalty or loss of services. If you withdraw, the data collected from interviews and tape recordings will be destroyed. **You as faculty participants may answer only questions that you feel comfortable and can choose to refrain from answering any questions that you do not like. You are free to request that the tape recorder be turned off at any time if so desired.**

3. **As you are faculty participants there is a risk of potential loss of anonymity as you may know each other. However, you are being interviewed individually by me in places of your choice and convenience and this loss of anonymity remains a potentially low risk. Further any information gathered will be presented in a summarized fashion and thus there is no risk of any one participant being identified.**

4. The tape will be transcribed and analyzed to discover the emerging patterns and themes discussed. You will be given a smoothed narrative version of the transcripts with false starts, repetitions, and paralinguistic utterances (um, eh etc) removed to make it more readable. Later, me the researcher will check with you about your responses in the transcriptions. You can add, delete or change information to reflect what you want to say. Once satisfied with the contents, *You will be asked to sign a Letter of Consent for Release of Transcripts (See Appendix C SAMPLE LETTER OF CONSENT FOR RELEASE OF TRANSCRIPTS). You will be able to receive a copy of the report generated in this context after mutual discussion.

5. The data collected from you will be kept in a secure place and will be held at the University of Saskatchewan with my supervisor Dr Keith Walker for five years according to the University of Saskatchewan guidelines (as *approved by University Council, December 8, 1993; revised February 21, 1994.*)

6. The results of the study will be used for completion of my Masters Thesis. The confidentiality and anonymity of you- the participants- will be protected through the use of pseudonyms.

If you have any questions about your participation or your rights as a participant in this study, you may contact the Office of Research Services at the University of Saskatchewan (966-2084) or you can contact me Dr Rani Kanthan, at Voice: 306 655 2158; Fax: 306 655 2223; e-mail rani.kanthan@saskatoonhealthregion.ca or my supervisor, Dr. Keith Walker (tel:). I, understand that this research project has been approved by the University of Saskatchewan Behavioral Research Ethics Board ----------and I agree to participate. I am aware of the nature of the study and understand what is expected of me and I also understand that I am free to withdraw at any time throughout the study. A copy of this form has been given to me for my records and at the end of the study, I will receive a copy of the report generated resulting from the data so collected.

I, _____, agree to participate in the above study as explained to me. I understand the guidelines outlined above. I have received a copy of the consent form for my records.

Date: _____	Participant's signature: _____

Date: _____	Researcher's signature:_____

APPENDIX C: CONSENT FORM FOR RELEASE OF TRANSCRIPTS / DATA

I appreciate your participation in the research study entitled ***"A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2006- May 2007."***

I am returning the transcripts of your audio-taped interviews for your perusal and the release of confidential information. I will adhere to the following guidelines which are designed to protect your anonymity, confidentiality and interests in this study.

1. Would you please read and recheck the transcripts for accuracy of information. You may add or clarify the transcripts to say what you intended to mean or include additional comments that will be your words. You may also delete any information that you may not want to be quoted in the study.
2. The interpretations from this study will be used for the completion of my Masters thesis. Except for the researcher in the study, your participation has remained confidential. Your name or any identifying descriptors will not be used in the final report or in any scholarly articles or presentations if you do not wish to have it used.
3. In accordance with the University of Saskatchewan Behavioral Research Ethics Board, the tape recordings, writing samples, and transcriptions made during the study will be kept with the instructor in a locked file until the study is finished. After completion of the study, the tapes and other data will be kept for five years at the University of Saskatchewan and then destroyed.
4. Participation in this study is voluntary, and you may withdraw at any time without penalty. If this happens, your tape recordings and interview data will be destroyed.

- I, _____understand the guidelines above and agree to release the revised transcripts to the researcher. A copy of the transcript release form is provided for your records. I have retained a copy of this form for my records.

- Date: _____Participant's signature: _____

- Date: _____Researcher' signature:_____

*As a research participant in this study, you may contact the Office of Research Services at the University of Saskatchewan (966-2084) if you have any questions about the study or you can reach me Dr Rani Kanthan at: Voice: 306 655 2158; Fax 306-655-2223; E-mail rani.kanthan@saskatoonhealthregion.ca or my supervisor, Dr. Keith Walker, Department of Educational Administration or the Saskatchewan Behavioral Research Ethics Board at 306-966 2084.

APPENDIX D : LETTER OF CONSENT FOR STUDENT PARTICIPANTS

Dr. Rani Kanthan
Associate Professor
Department of Pathology
College of Medicine
University of Saskatchewan

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I appreciate your participation in the research study entitled ***"A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2007- May 2007."***

The main objective of this research is to investigate the advantages and disadvantages of the two models of horizontal and vertical integration of the teaching of pathology through an analysis of the perceptions of individual medical educators and Year 1 and Year 2 students in the undergraduate curriculum at the College of Medicine in Saskatoon based contextually within the theoretical framework of the newly designed medical curriculum. This is in keeping with the global redesign of the undergraduate medical curriculum at this institution.

The procedure(s) to be followed include filling in a questionnaires, as part of data gathering instruments, in a in-class room activity. There will be no extra time commitment of the participant. The study will take place where the participant is reading the consent form. No potential foreseeable risks, side effects or discomforts are expected in this study.
Participation is purely on a voluntary basis. The participant is free to withdraw from the study at any time and this withdrawal will in no way affect the participants' academic status, and/or access to, or continuation of, services provided by public agencies such as the University, hospitals, social services, schools, etc. When a participant withdraws, his/her data will be deleted from the study and destroyed, if so desired by the participant.

Utmost precautions will be taken to protect the confidentiality and anonymity of the participant, including the storage of all questionnaires and documents safely with my supervisor Dr Keith Walker for five years according to the University of Saskatchewan guidelines (as *approved by University Council, December 8, 1993; revised February 21, 1994.*)

The data collected will be reported anonymously in aggregate form with complete de-identification of the data. Such results will be shared with other interested members of the medical educators at local, national and international levels at conferences and meetings by workshops or paper and poster presentations. Trends observed and any other interesting aspects or experiences will also be shared by publications in related journals. The articles published will be accessible via PUBMED or other such search engines on the Internet as available.

During this study period I will advise the participant of any new information that will have a bearing on his/her's decision to participate, if there is any reasonable probability of such an occurrence. Such an eventuality occurring is however highly unlikely.

Completion of the given task/ survey /questionnaire will constitute consent to participate and permission for me, the researcher to use the data gathered in the manner described.

This proposed research project was reviewed and approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on January 2007

If you have any questions with regard to this study or to your rights as a participant in this research study please feel free to contact the Ethics Office (306) 966-2084.

A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2007- May 2007.

APPENDIX E: CONSENT FORM FOR STUDENT FOCUS GROUP INTERVIEWS

You are invited to participate in a focus group as part of a study entitled "A comparative study of the perceptions of students and faculty to the integration of pathology teaching in the undergraduate medical curriculum for the academic year period of January 2007- May 2007". Please read this form carefully, ask questions you might have, and if you agree, sign and date the form and bring it with you to the focus group session.

Researcher: Masters in Medical education Student: Dr. Rani Kanthan under the Supervision of Drs Keith Walker, Educational Administration, College of Education and Marcel D'Eon, Educational Support and Development, College of Medicine, University of Saskatchewan, (306) 966-2756 and marcel.deon@usask.ca.. Dr Marcel D'Eon will be responsible for this focus group interview data. The de-identified aggregate data will be provided to Dr Rani Kanthan for further analysis.

Purpose and Procedure: The purpose of this study is to monitor the newly implemented integrated curriculum through the lens of the students. In this study we hope to explore the perceptions of students and faculty to the vertical and horizontal integration of pathology teaching in the modules 7, 10, 12 and Path course 201.3 and 302.9. The students would have participated in filling up the survey questionnaires in class. These focus group interviews will be an added opportunity to capture any further trends, perceptions and concerns that may not have been addressed in the preliminary survey questionnaires.

Potential Risks: There are no inherent risks to participating in this research. Perhaps to maintain the good will of their instructors, course coordinator some students may feel an obligation to participate. To minimize this potential compulsion the course coordinator or the instructors are not involved in the data collection. Participation is confidential and all data is anonymous.

Potential Benefits: There are some direct benefits to the participants in this study. We will be learning about the advantages and disadvantages of the structural organization of pathology teaching in the newly integrated undergraduate medical curriculum. Their suggestions and recommendations will be considered and incorporated into the future planning, redesign and restructure of the curriculum through recommendations to the Curriculum Committee.

Confidentiality: Dr. D'Eon will be the only person to have access to the raw data. Although the data from this study may be published or presented at conferences and will be used in reports for the Masters Thesis the data will be reported in aggregate form, so that it will not be possible to identify individuals. Moreover, the consent forms will be stored separately from the focus group data so that it will not be possible to associate a name with any given set of responses. The researcher will undertake to safeguard the confidentiality of the focus group discussion, but cannot guarantee that other members of the focus group will do so. Please respect the confidentiality of the other members of the group by not disclosing the contents of this

discussion outside the group, and be aware that others may not respect your confidentiality. Because the participants for this focus group have been selected from a group of people, all of whom are known to each other; it is possible that you may be identifiable to other people on the basis of what you have said if direct quotes are used in reporting.

After the focus group session, and prior to the data being included in the final report, you will be given the opportunity to review the summary, and to add, alter, or delete information (such as direct quotes) from the summary as you see fit.

Right to Withdraw: Your participation is voluntary, and you may withdraw from the study for any reason, at any time, without penalty of any sort. Please do not feel that you are obligated to attend this focus group. At any time if you choose to withdraw from the study you may request of the researcher that your data be expunged and destroyed.

Questions: If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact Dr. D'Eon if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on (insert date). Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Results of the study will be disseminated in the Masters Thesis and may be presented at conferences and published in scholarly journals.

Consent to Participate: I have read and understood the description provided above; I have been provided with an opportunity to ask questions and my questions (if I had any) have been answered satisfactorily. I consent to participate in the study described above with the understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

_____	_____
(Name of Participant)	(Date)
_____	_____
(Signature of Participant)	(Signature of Researcher)

Appendix 4.1. Survey Results in the vertically integrated ITDL 206.18

(one-way ANOVA analysis of Modules 7 (GI), 10 (Imm) & 12 (IS) between and within the first year's medical and dental students).

Question Number	SURVEY QUESTIONNAIRE Administered at the end of Modules 7 (Gastrointestinal), 10 (Immunology), and 12 (Interacting Systems)	N=142 Medical Student Responses Mean	N=68 Dental Student Responses Mean	Perceptions of Medical students versus Dental Students P Value	GI (7) Mean	Imm (10) Mean	IS (12) Mean	Grand Mean {7+10+12}	Perceptions of Intermodular Differences Between Modules 7, 10, and 12 P value
	FACTOR 1 Student learning satisfaction with integration	3.71	3.33	**.001**	3.56	3.63	3.49	3.56	.594
Q 1	The introduction of Path & Lab content in this module facilitates my learning	3.93	3.04		3.51	3.54	3.67	3.58	
Q 2	The introduction of Path & Lab content in this module helps me understand concepts of basic pathological processes in relation to their normal anatomy and physiology	3.82	3.07		3.65	3.65	3.82	3.71	
Q 3	The integration of Path & Lab content in this module helps me construct meaning into the link of pathological processes from the normal to the diseased states	3.89	3.11		3.80	3.74	3.77	3.77	
Q 4	I am satisfied with the integration of Path & Lab content in this module	3.64	3.09		3.35	3.73	3.75	3.60	
Q 5	This integration of Path & Lab content in this module enhanced the effectiveness of my study skills	3.78	2.74		2.90	3.23	3.26	3.11	
Q 6	The integration of Path & lab content in this module helps me to understand and problem solve the case based questions in this module	3.63	3.02		3.46	3.39	3.64	3.50	
Q 8	Overall I am satisfied with the organization of Path & Lab content in this module	3.67	3.23		3.50	3.70	3.63	3.60	
Q 9	The integration of Path & Lab content in this module has contributed to my overall educational growth and development	3.64	3.05		3.48	3.57	3.53	3.52	
Q I0	The integration of Path & Lab content in this module has facilitated enhancement of my analytical thinking skills	3.54	3.01		3.51	3.42	3.36	3.44	
Q 11	The integration of Path & Lab content in this module is an effective use of my class time	3.79	3.14		3.84	3.71	3.66	3.74	
Q 12	The integration of Path & Lab content in this module has contributed to my learning	3.87	3.12		3.73	3.75	3.77	3.75	
Q 14	The exam questions for the Path & Lab content in this module were matched to their goals and objectives	3.69	2.94		3.58	3.56	3.37	3.52	
Q 18	The integration of Path & Lab content in this module enhances my motivation to learn	3.47	2.28		3.13	3.25	3.51	3.29	
Q 26	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to relate ideas in one subject to another	4.32	3.05		4.20	4.04	4.10	4.12	

	FACTOR 2 Learning with understanding and vocational relevance and integration	3.71	3.10	**..000**	3.44	3.52	3.55	3.50	.585
Q 33	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module used a variety of learning strategies that work for me	3.59	3.02		3.48	3.49	3.35	3.44	
Q 34	I am rarely bored in this interdisciplinary learning environment	3.20	2.51		2.80	2.95	3.19	2.98	
Q 36	I feel the multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) is preparing me well for my profession	3.81	2.81		3.56	3.44	3.44	3.49	
Q 39	The contact teaching time in this multidisciplinary integrated module is utilized effectively	3.45	3.08		3.23	3.39	3.49	3.36	
Q 40	I find multi-integrated classroom experience stimulating	3.58	3.00		3.31	3.26	3.58	3.39	
Q 41	The classroom teaching styles in this module encourage me to be an active participant in my learning	3.55	2.87		3.19	3.46	3.39	3.33	
Q 42	The multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) has shown me how much of what I learn today seems relevant to my future training for a future career in health care	3.95	2.81		3.28	3.54	3.63	3.47	
Q 45	The multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology) teaching has helped me to recognize the relationship within and between the various disciplines	4.23	3.76		4.01	4.04	3.93	3.99	
Q 46	Overall I have learned with understanding a great deal in this multidisciplinary integrated module	3.96	3.03		3.74	3.68	3.65	3.69	
Q 47	I consider what I learned in this multidisciplinary integrated module to be valuable to my future training for a career in health care	4.16	3.09		3.60	3.70	3.83	3.71	
Q 48	Overall I am satisfied with the quality of Path & Lab content in this multidisciplinary integrated module	3.86	3.03		3.58	3.58	3.64	3.60	
	FACTOR 3 Analytical learning and integration	3.78	3.25	**.000**	3.66	3.49	3.64	3.61	.331
Q 21	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages my independent study	4.07	3.35		3.84	3.63	3.74	3.75	
Q 22	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) provides me with opportunities for interpersonal learning activities	3.71	3.03		3.38	3.32	3.44	3.38	
Q 23	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to reflect on how I am learning	3.90	3.12		3.69	3.30	3.55	3.53	
Q 24	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages reflection on the content material discussed	4.00	3.40		3.76	3.61	3.74	3.71	
Q 25	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to question what I hear in lectures	3.77	3.09		3.53	3.25	3.54	3.45	
Q 26	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to relate	4.44	3.71		4.20	4.04	4.10	4.12	

	ideas in one subject to another								
Q 27	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.45	3.12		3.24	3.30	3.49	3.34	
	FACTOR 4 Learning environment and integration	3.95	3.51	**.000**	3.82	3.77	3.82	3.81	.869
Q 15	The learning climate of the classroom in this module is positive	4.28	3.78		4.00	3.98	4.13	4.04	
Q 37	I feel comfortable in the classroom learning environment of this module	4.14	3.13		3.80	3.81	3.85	3.82	
Q 38	The atmosphere is relaxed during the lectures in this module	4.05	3.23		3.89	3.49	3.79	3.75	
Q 43	Multidisciplinary integrated teaching has facilitated me to interact easily with other students in my class	3.77	3.09		3.40	3.54	3.51	3.48	
Q 45	The multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology) teaching has helped me to recognize the relationship within and between the various disciplines	4.23	3.06		4.01	4.04	3.93	3.99	
	FACTOR 5 Student engagement and integration	3.36	3.06	**.007**	3.05	3.35	3.42	3.26	**.004****
Q 19	The integration of Path & Lab content in this module encourages the student engagement in the classroom	3.46	2.76		3.01	3.33	3.37	3.22	
Q 20	Integration of the Path and lab content in this module encourages active learning opportunities (in class questions, discussion, group activities)	3.42	2.97		2.95	3.33	3.32	3.18	
Q 39	The contact teaching time in this multidisciplinary integrated module is utilized effectively	3.61	3.18		3.23	3.39	3.49	3.36	
	FACTOR 6 Focus and clarity of goals and objectives in integrative environments	3.68	3.35	**.021**	3.52	3.68	3.50	3.56	.478
Q 13	There were clear goals and objectives for Path & Lab content in this module	3.78	3.27		3.46	3.81	3.60	3.60	
Q 14	The exam questions for the Path & Lab content in this module were matched to their goals and objectives	3.88	3.19		3.58	3.56	3.37	3.52	
	FACTOR 7 Student stress load with integration	2.95	2.99	.757	2.81	3.11	3.02	2.96	.062
Q 16	I found the workload related to the Path & Lab component to be stressful	2.73	2.82		2.39	3.07	2.92	2.76	
Q 28	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) promotes rote memorization of important facts (memorization by repetition without comprehension)	2.95	2.94		2.89	3.00	2.97	2.95	
Q 44	I find that multidisciplinary curriculum has increased my stress load	3.18	3.21		3.13	3.26	3.20	3.19	
	FACTOR 8 Self-directed student-driven learning in integrative environments	3.49	3.02	**.000**	3.26	3.31	3.43	3.33	.242
Q 5	This integration of Path & Lab content in this module enhanced the effectiveness of my study skills	3.35	2.97		2.90	3.23	3.26	3.11	
Q 6	The integration of Path & lab content in this module helps me to understand and problem solve the case based	3.79	3.24		3.46	3.39	3.64	3.50	

	questions in this module								
Q 21	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages my independent study	4.07	3.35		3.84	3.63	3.74	3.75	
Q 30	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) has facilitated the move from time spent in formal class to time spent in independent study	3.60	2.91		3.21	3.30	3.32	3.27	
Q 31	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) has provided an opportunity for the choice of the schoolwork to be done	3.39	2.66		2.94	3.00	3.18	3.04	
	FACTOR 9 Teacher feedback and integration	3.28	3.19	442	3.27	3.23	3.25	3.25	.956
Q 32	There are opportunities for teaching staff to provide helpful feedback in this multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module	3.25	3.12		3.28	3.11	3.21	3.21	
Q 35	The teaching in the integrated curriculum is well focused	3.31	3.27		3.27	3.32	3.32	3.30	
	FACTOR 10 Multidisciplinary interrelationships in integration	3.67	3.63	.741	3.58	3.75	3.68	3.66	.447
Q 29	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) is NOT well integrated	2.76	2.49		2.84	2.53	2.60	2.67	
Q 29r	Question 29 Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) is NOT well integrated-REVERSED SCORES	3.24	3.51		3.16	3.47	3.40	3.33	
Q 45	The multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology) teaching has helped me to recognize the relationship within and between the various disciplines	4.10	3.76		4.01	4.04	3.93	3.99	
	FACTOR 11 Application-learner centered and integration	3.53	3.43	.394	3.50	3.34	3.63	3.50	.135
Q 7	The path & lab content in this module emphasizes application of knowledge rather than simple recall of factual knowledge	3.72	3.43		3.78	3.33	3.67	3.62	
Q 17	Integrated Path & Lab content in this module is moving toward being learning centered rather than being content centered	3.35	3.44		3.20	3.35	3.60	3.38	

Appendix 4.2. Survey results in the horizontally integrated PATH 201.3
(One way ANOVA Analysis first-year medical and dental student's (levels of significance (p<0.05)* (p<0.01)(p<0.000)***)**

Question Number	Survey Questionnaire Administered at the End of Midterm and Final Exam	N= 117 Medical Student Responses Mean	N=56 Dental Student Responses Mean	Grand Mean of all Student (173) Responses	Perceptions of Medical versus Dental Students
	FACTOR 1 Student learning satisfaction	3.91	3.29	3.72	**.000*** **
Q1	Pathology teaching in this course facilitates my learning	4.06	3.63	3.92	
Q2	Pathology teaching in this course helps me understand concepts of basic pathological processes in relation to their physiological and anatomical basis	4.05	3.57	3.90	
Q3	Pathology teaching in this course helps me construct meaning into the link of pathological processes from the normal to the diseased states	4.13	3.63	3.97	
Q4	I am satisfied with the organizational structure of the integrated approach of pathology teaching in this Terms II Pathology stand alone course	3.84	3.35	3.68	
Q5	The pathology teaching in this course enhances the effectiveness of my study skills	3.43	2.98	3.28	
Q6	The organizational structure of integrated pathology teaching helps me understand and solve case based questions in the exams for this course	3.72	3.27	3.58	
Q7	The examination questions for this course emphasizes application of knowledge rather than simple recall of factual knowledge	3.97	3.87	3.94	
Q8	Overall I am satisfied with the independent integrated structure of pathology teaching in this systemic pathology course	3.86	3.39	3.71	
Q9	The pathology teaching in this course has contributed to my overall educational growth and development	3.95	3.36	3.76	
Q10	The pathology teaching in this course has facilitated enhancement of my analytical thinking skills	3.97	338	3.77	
Q11	The pathology teaching in this course is an effective use of my class time	3.86	3.30	3.68	
Q12	The pathology teaching in this course has contributed to the quality of my learning this term	3.92	3.37	3.75	
Q18	The pathology teaching in this Term II course enhances my motivation to learn	3.71	2.86	3.43	
Q26	The pathology teaching in this course encourages me to relate ideas in one subject to another	4.08	3.46	3.88	
Q33	The pathology teaching in this course uses a variety of learning strategies that work for me	3.62	3.02	3.42	
Q34	I am rarely bored in this learning environment	3.67	3.16	3.51	
Q35	The pathology teaching in this course is well focused	3.69	3.29	3.56	
Q36	I feel the pathology teaching in this course is preparing me well for my profession	4.04	2.98	3.70	
Q39	The contact classroom teaching time in this course is put to good use	3.91	3.32	3.72	
Q40	I find the classroom experience stimulating	3.92	3.20	3.69	
Q41	The teaching of pathology in this course encourages me to be an active participant in my own learning	3.87	3.13	3.63	

Q42	The pathology teachings in this course has shown me how much of what I learn today seems relevant to my future training for a career in healthcare	4.17	3.13	3.83	
Q45	Pathology teachings in this course have strengthened my foundations by recognizing the interrelationships within and between the various disciplines	3.90	3.38	3.73	
Q46	Overall I have learned with understanding a great deal in this course	4.06	3.36	3.83	
Q47	I consider the pathology teachings in this course to be valuable to my future training for a career in healthcare	4.24	3.29	3.93	
Q48	Overall I am satisfied with the integrated structure of patho0logy teaching as an independent stand alone course in Term II	3.98	3.45	3.81	
	FACTOR 2 Analytical learning	3.61	3.25	3.50	**.001*** **
Q21	The pathology teaching in this course encourages my independent study	3.79	3.34	3.64	
Q22	The pathology teaching in this course encourages me to reflect on how I am learning	3.53	3.04	3.37	
Q24	The pathology teaching in this course encourages me to reflect on the content material discussed	3.70	3.36	3.59	
Q25	The pathology teaching in this course encourages me to question things I hear in lectures	3.60	3.29	3.50	
Q27	The pathology teaching in this course encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.72	3.41	3.62	
Q32	There are opportunities for teaching staff to provide helpful feedback in this integrated curriculum	3.36	3.04	3.25	
Q45	Pathology teachings in this course have strengthened my foundations by recognizing the interrelationships within and between the various disciplines	3.90	3.38	3.73	
	FACTOR 3 Focus and clarity of goals and objectives	3.84	3.40	3.70	**.001*** **
Q13	There were clear goals and objectives for this course.	3.97	3.61	3.86	
Q14	The examination questions were matched to the goals and objectives of this section in the course	4.03	3.45	3.84	
Q29	The pathology teaching in this course as it is NOT clearly structured	2.33	2.84	2.50	
Q35	The pathology teaching in this course is well focused	3.69	3.29	3.56	
	FACTOR 4 Student engagement	3.65	3.30	3.54	**.003*** **
Q17	The pathology teaching in this course is moving towards being learning centered rather than being content centered	3.56	3.34	3.49	
Q19	The pathology teaching in this course encourages the student engagement in the classroom	3.84	3.46	3.72	
Q20	The pathology teaching in this course encourages active learning opportunities (in class questions, discussion, group activities)	3.74	3.43	3.64	
Q23	The pathology teaching in this course provides me with opportunities for interpersonal learning activities	3.59	3.32	3.50	
Q32	There are opportunities for teaching staff to provide helpful feedback in this integrated curriculum	3.36	3.04	3.25	
	FACTOR 5 Learning environment	4.20	3.53	3.99	**.000*** **
Q15	The learning climate of the pathology teaching classroom is positive	4.39	3.93	4.24	
Q36	I feel the pathology teaching in this course is preparing me well for my profession	4.04	2.98	3.70	
Q37	I feel comfortable in the classroom learning environment	4.58	3.64	4.27	
Q38	The atmosphere is relaxed during the lectures in this course	4.03	3.57	3.88	

Q42	The pathology teachings in this course has shown me how much of what I learn today seems relevant to my future training for a career in healthcare	4.17	3.13	3.83	
Q45	Pathology teachings in this course have strengthened my foundations by recognizing the interrelationships within and between the various disciplines	3.90	3.38	3.73	
Q47	I consider the pathology teachings in this course to be valuable to my future training for a career in healthcare	4.24	3.29	3.93	
	FACTOR 6 Student stress	3.29	2.87	3.15	**.008*** **
Q16	I found the workload related to this course stressful	2.54	2.91	2.66	
Q44	The pathology teaching in this course has increased my stress load	2.85	3.38	3.02	
	FACTOR 7 Self-directed Learning / academic self-perception	3.61	3.12	3.45	**.000*** **
Q23	The pathology teaching in this course provides me with opportunities for interpersonal learning activities	3.59	3.32	3.50	
Q30	Integration curriculum design of this first year medical school has facilitated the move from time spent in formal classes to time spent in independent study	3.66	3.11	3.48	
Q31	The pathology teaching in this course provides me with an opportunity of the choice in the work to be done for this course	3.21	2.82	3.08	
	FACTOR 8 Student interactions	3.94	3.47	3.45	**.000*** **
Q23	The pathology teaching in this course provides me with opportunities for interpersonal learning activities	3.59	3.32	3.50	
Q33	The pathology teaching in this course uses a variety of learning strategies that work for me	3.62	3.02	3.42	
Q34	I am rarely bored in this learning environment	3.67	3.16	3.51	
Q43	I interact easily with other students in this course	4.29	4.07	4.22	
	FACTOR 9 Deep learning	3.07	3.05	3.06	0.934
Q28	The pathology teaching in this course promotes rote memorization of important facts (memorization by repetition without comprehension)	3.08	3.04	3.06	

Appendix 4.3. Survey results in the horizontally integrated PATH 302.9

One Way ANOVA Analysis of second year medical student perception between the three systems Gastrointestinal (GI), Neurology (Neuro) and at the end of the Final Examination (Final) .Total number of student responses =156 (GI 42 + Neuro 54 and Final 60).

Levels of significance (p<0.05)* (p<0.01) ** (p<0.000) ***

Question Number	Survey Questionnaire Administered at the End of Three Systems—GI, Neuro (N), and End of Course Final (F) Examination	GI Mean	Neuro (N) Mean	Final (F) Mean	Grand Mean (GI+N+F)	Perceptions of Intersystem Differences Between GI / N/ F
	FACTOR 1 Student learning satisfaction	3.70	3.48	3.98	3.70	**0.002*****
Q1	The pathology teaching in this course facilitates my learning	4.05	3.80	4.03	3.96	
Q2	The pathology teaching in this course helps me understand concepts of basic pathological processes in relation to their normal anatomy and physiology	4.02	3.72	4.10	3.95	
Q3	The pathology teaching in this course helps me construct meaning into the link of pathological processes from the normal to the diseased states	3.86	3.65	4.13	3.89	
Q5	This pathology teaching in this course enhances the effectiveness of my study skills	3.36	3.15	3.43	3.31	
Q6	The organizational structure of integrated pathology teaching helps me understand and solve case based questions in the exams for this course	3.67	3.35	3.93	3.66	
Q7	The review and examination questions for this course emphasizes application of knowledge rather than simple recall of factual knowledge	4.07	3.57	4.20	3.95	
Q8	Overall I am satisfied with the independent integrated structure of pathology teaching in this systemic pathology course	3.86	3.69	4.08	3.88	
Q9	The pathology teaching in this course has contributed to my overall educational growth and development	3.92	3.63	4.07	3.88	
Q10	The pathology teaching in this course has facilitated enhancement of my analytical thinking skills	3.76	3.28	3.92	3.65	
Q11	The pathology teaching in this course is an effective use of my class time	3.33	3.20	3.58	3.38	
Q12	The pathology teaching in this course has contributed to the quality of my learning this term	3.74	3.68	3.90	3.78	
Q14	The examination questions fairly matched to the goals and objectives of this section in the course	3.43	3.23	4.02	3.59	
Q29	This integration of systemic pathology is NOT clearly structured	2.26	2.28	2.15	2.22	
Q33	This integration of systemic pathology uses a variety of learning strategies that work for me	3.45	3.19	3.58	3.41	
Q34	I am rarely bored in this learning environment	3.17	2.89	3.34	3.14	
Q35	The pathology teaching in this course is well focused	3.57	3.54	3.63	3.58	
Q36	I feel the pathology teaching in this course is preparing me well for my profession	3.67	3.41	3.93	3.68	
Q40	I find the classroom experience in this course stimulating	3.43	3.11	3.60	3.38	
Q42	This integration of systemic pathology has shown me how much of what I learn today seems relevant to my future training for a career in healthcare	3.88	3.78	3.84	3.83	
Q46	Overall I have learned with understanding a great deal in this course	3.81	3.50	3.93	3.75	
Q48	I consider what I learned in this course to be valuable to my future training for a career in healthcare	3.98	3.76	4.25	4.01	
Q49	Overall I am satisfied with the integration of the teaching of systemic pathology with the teaching of systems	3.88	3.72	4.08	3.90	
	FACTOR 2 Student engagement	3.57	3.48	3.89	3.66	**0.004*****
Q14	The examination questions fairly matched to the goals and objectives of this section in the course	3.43	3.23	4.02	3.59	

Q19	The pathology teaching in this course encourages the student engagement in the classroom	3.75	3.81	3.92	3.84	
Q20	The integration of systemic pathology encourages active learning opportunities (in class questions, discussion, group activities)	3.83	3.76	3.93	3.85	
Q23	This integration of systemic pathology provides me with opportunities for interpersonal learning activities	3.29	3.11	3.68	3.38	
	FACTOR 3 Learning environment	3.94	4.22	4.37	4.20	**0.001*** **
Q15	The learning climate of the pathology teaching classroom is positive	4.10	4.30	4.55	4.34	
Q37	I feel comfortable in the classroom learning environment of this course	3.90	4.13	4.27	4.12	
Q38	The atmosphere is relaxed during the lectures in this course	3.81	4.22	4.30	4.14	
	FACTOR 4 Interrelated learning	4.02	3.81	4.16	4.00	**0.021***
Q7	The review and examination questions for this course emphasizes application of knowledge rather than simple recall of factual knowledge	4.07	3.57	4.20	3.95	
Q26	This integration of systemic pathology encourages me to relate ideas in one subject to another	4.14	4.02	4.25	4.14	
Q45	Pathology teachings in this course help me to recognize the interrelationships within and between various disciplines	3.86	3.85	4.07	3.94	
Q47	Last years work provides a continuum--foundation for this years work	4.00	3.81	4.11	3.98	
	FACTOR 5 Student self-learning	3.84	3.76	4.04	3.89	**0.030***
Q18	The integration of systemic pathology to the teaching of systems enhances my personal motivation to learn	3.71	3.50	3.92	3.72	
Q21	This integration of systemic pathology encourages me to study independently	3.69	3.67	4.00	3.80	
Q41	The teaching of pathology in this course encourages me to be an active participant in my own learning	3.69	3.63	3.93	3.76	
Q43	I interact easily with other students in this course	4.29	4.26	4.35	4.30	
	FACTOR 6 Self-directed learners	3.12	3.17	3.41	3.25	0.127
Q30	This integration of systemic pathology has facilitated the move from time spent in formal classes to time spent in independent study	3.17	3.39	3.53	3.38	
Q31	This integration of systemic pathology provides me with an opportunity of the choice in the work to be done for this course	3.07	2.96	3.30	3.12	
Q32	There are opportunities for teaching staff to provide helpful feedback in this integrated systemic pathology course	2.93	2.96	3.32	3.09	
	FACTOR 7 Student stress					0.693
Q16	I found the workload related to this course stressful	2.95	2.89	3.10	2.99	
Q44	The pathology teaching in this course has increased my stress load	3.19	3.17	3.25	3.21	
	FACTOR 8 Analytical learning	3.43	3.20	3.40	3.34	0.084
Q5	This pathology teaching in this course enhances the effectiveness of my study skills	3.36	3.15	3.43	3.31	
Q17	The pathology teaching in this course is learning centered rather than being content centered	2.71	2.56	2.36	2.52	
Q22	This integration of systemic pathology encourages me to reflect on how I am learning	3.38	3.13	3.70	3.42	
Q24	This integration of systemic pathology encourages reflection on the content material discussed	3.88	3.57	3.83	3.76	
Q25	This integration of systemic pathology encourages me to question things I hear in lectures	3.81	3.59	3.70	3.69	
	FACTOR 9 Contact teaching	3.50	3.46	3.60	3.53	0.693
Q39	The contact classroom teaching time in this course is put to good use	3.50	3.46	3.61	3.53	
	FACTOR 10 Focus and clarity of goals and objectives	3.60	3.51	3.89	3.68	**0.010****

Q13	The goals and objectives for this course are clearly stated	3.98	4.19	4.33	4.19	
Q14	The examination questions fairly matched to the goals and objectives of this section in the course	3.43	3.23	4.02	3.59	
Q35	The pathology teaching in this course is well focused	3.57	3.54	3.63	3.58	
Q40	I find the classroom experience in this course stimulating	3.43	3.11	3.60	3.38	
Q42	This integration of systemic pathology has shown me how much of what I learn today seems relevant to my future training for a career in healthcare	3.88	3.78	3.84	3.83	
	FACTOR 11 Horizontal temporal alignment	3.82	3.77	3.84	3.81	0.915
Q4	I am satisfied with the organizational structure of the integrated approach of pathology teaching in this Systemic Pathology (stand alone) course in Terms I, II, & III (Phase B&C)	3.90	3.83	3.83	3.85	
Q29	This integration of systemic pathology is NOT clearly structured	2.26	2.28	2.15	2.22	
	FACTOR 12 Deep learning (learning with understanding)	3.69	3.75	3.91	3.80	0.216
Q27	This integration of systemic pathology encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.64	3.78	3.98	3.82	
Q28	This integration of systemic pathology promotes rote memorization of important facts (memorization by repetition without comprehension)	2.24	2.44	2.73	2.50	

Appendix 4.4. Survey results of First-year versus second-year medical students in horizontal integration

Deleted: 4. Factor File analysis

Final exam PATH 302 versus final exam PATH 201

Question Number	Survey Questionnaire Matched Items for the Two Courses	N= 59 First-Year Students Mean	N=60 Second-Year Students Mean	ANOVA Differences Between the Means by Factor Analysis
	FACTOR 1 Student learning satisfaction	3.91	3.84	0.480
Q1	Pathology teaching in this course facilitates my learning	4.07	4.03	
Q2	Pathology teaching in this course helps me understand concepts of basic pathological processes in relation to their physiological and anatomical basis	4.08	4.10	
Q3	Pathology teaching in this course helps me construct meaning into the link of pathological processes from the normal to the diseased states	4.22	4.13	
Q4	I am satisfied with the organizational structure of the integrated approach of pathology teaching in this Terms II Pathology stand alone course	4.03	3.90	
Q5	The pathology teaching in this course enhances the effectiveness of my study skills	3.58	3.43	
Q6	The organizational structure of integrated pathology teaching helps me understand and solve case based questions in the exams for this course	3.75	3.93	
Q8	Overall I am satisfied with the independent integrated structure of pathology teaching in this systemic pathology course	3.93	4.08	
Q9	The pathology teaching in this course has contributed to my overall educational growth and development	4.02	4.07	
Q10	The pathology teaching in this course has facilitated enhancement of my analytical thinking skills	3.98	3.92	
Q11	The pathology teaching in this course is an effective use of my class time	4.00	3.58	
Q12	The pathology teaching in this course has contributed to the quality of my learning this term	4.14	3.90	
Q13	There were clear goals and objectives for this course.	4.10	4.41	
Q14	The examination questions were matched to the goals and objectives of this section in the course	4.03	4.08	
Q17	The pathology teaching in this course is moving towards being learning centered rather than being content centered	3.59	3.66	
Q33	The pathology teaching in this course uses a variety of learning strategies that work for me	3.63	3.58	
Q34	I am rarely bored in this learning environment	3.61	3.34	
Q35	The pathology teaching in this course is well focused	3.71	3.63	
Q36	I feel the pathology teaching in this course is preparing me well for my profession	4.10	3.93	
Q39	The contact classroom teaching time in this course is put to good use	3.95	3.61	
Q45	Overall I have learned with understanding a great deal in this course	4.19	3.93	
Q47	Overall I am satisfied with the integrated structure of pathology teaching as an independent stand alone course in Term II	4.05	4.08	

	FACTOR 2 Analytic learning and relevance	4.02	3.97	0.677
Q9	The pathology teaching in this course has contributed to my overall educational growth and development	4.02	4.07	
Q10	The pathology teaching in this course has facilitated enhancement of my analytical thinking skills	3.98	3.92	
Q18	The pathology teaching in this Term II course enhances my motivation to learn	3.78	3.92	
Q24	The pathology teaching in this course encourages me to reflect on the content material discussed	3.80	3.83	
Q26	The pathology teaching in this course encourages me to relate ideas in one subject to another	4.10	4.32	
Q34	I am rarely bored in this learning environment	3.61	3.34	
Q36	I feel the pathology teaching in this course is preparing me well for my profession	4.10	3.93	
Q42	The pathology teachings in this course has shown me how much of what I learn today seems relevant to my future training for a career in healthcare	4.22	3.91	
Q45	Overall I have learned with understanding a great deal in this course	4.19	3.93	
Q46	I consider the pathology teachings in this course to be valuable to my future training for a career in healthcare	4.27	4.25	
	FACTOR 3 Learning environment	4.17	4.06	0.311
Q15	The learning climate of the pathology teaching classroom is positive	4.47	4.55	
Q34	I am rarely bored in this learning environment	3.61	3.34	
Q37	I feel comfortable in the classroom learning environment	4.32	4.27	
Q38	The atmosphere is relaxed during the lectures in this course	4.12	4.30	
Q39	The contact classroom teaching time in this course is put to good use	3.95	3.61	
Q40	I find the classroom experience stimulating	4.02	3.60	
	FACTOR 4 Student engagement, active learning	3.59	3.84	**0.04***
Q19	The pathology teaching in this course encourages the student engagement in the classroom	3.76	3.92	
Q20	The pathology teaching in this course encourages active learning opportunities (in class questions, discussion, group activities)	3.63		
Q23	The pathology teaching in this course provides me with opportunities for interpersonal learning activities	3.39	3.68	
	FACTOR 5 Student self-learning	3.78	3.88	0.33
Q18	The pathology teaching in this Term II course enhances my motivation to learn	3.78	3.92	
Q22	The pathology teaching in this course encourages me to reflect on how I am learning	3.49	3.70	
Q24	The pathology teaching in this course encourages me to reflect on the content material discussed	3.80	3.83	
Q25	The pathology teaching in this course encourages me to question things I hear in lectures	3.71	3.70	
Q26	The pathology teaching in this course encourages me to relate ideas in one subject to another	4.10	4.32	
	FACTOR 6 Course structure and learning	3.67	3.69	0.921
Q29	The pathology teaching in this course as it is NOT clearly structured	2.29	2.15	
Q33	The pathology teaching in this course uses a variety of learning strategies	3.63	3.58	

	that work for me			
Q35	The pathology teaching in this course is well focused	3.71	3.63	
	FACTOR 7 Student stress	2.53	3.17	**0.000*** **
Q16	I found the workload related to this course stressful	2.46	3.10	
Q44	The pathology teaching in this course has increased my stress load	2.61	3.25	
	FACTOR 8 Focus, goals, and objectives	4.15	4.29	0.208
Q13	There were clear goals and objectives for this course.	4.10	4.41	
Q14	The examination questions were matched to the goals and objectives of this section in the course	4.03	4.08	
Q29	The pathology teaching in this course as it is NOT clearly structured	2.29	2.15	
Q35	The pathology teaching in this course is well focused	3.71	3.63	
Q43	I interact easily with other students in this course	4.31	4.35	
	Factor 9 Self-independent learning	3.41	3.38	0.817
Q30	Integration curriculum design of this first year medical school has facilitated the move from time spent in formal classes to time spent in independent study	3.66	3.53	
Q31	The pathology teaching in this course provides me with an opportunity of the choice in the work to be done for this course	3.29	3.30	
Q32	There are opportunities for teaching staff to provide helpful feedback in this integrated curriculum	3.27	3.32	
	FACTOR 10 Student independent study	3.82	3.82	0.982
Q21	The pathology teaching in this course encourages my independent study	3.81	4.00	
Q30	Integration curriculum design of this first year medical school has facilitated the move from time spent in formal classes to time spent in independent study	3.66	3.53	
Q41	The teaching of pathology in this course encourages me to be an active participant in my own learning	3.93	3.93	
	FACTOR 11 Knowledge creation	3.54	3.70	0.147
Q7	The examination questions for this course emphasizes application of knowledge rather than simple recall of factual knowledge	4.05	4.2	
Q17	The pathology teaching in this course is moving towards being learning centered rather than being content centered	3.59	3.66	
Q28	The pathology teaching in this course promotes rote memorization of important facts (memorization by repetition without comprehension)	3.02	2.73	
	FACTOR 12 Evidence-based medicine	3.89	3.79	0.378
Q27	The pathology teaching in this course encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.78	3.98	

Appendix 4.5. Student Perceptions of Vertical versus Horizontal Integration

One-way ANOVA comparison analysis of student perceptions between the ITDL-Module 7 (vertical) and PATH 201-midterm (horizontal)

Levels of significance (p<0.05)* (p<0.01) ** (p<0.000) ***

Question Number	Survey Questionnaire Items	Vertical Integration Mean of 80 Student Responses	Horizontal Integration Mean of 85 Student Responses	Grand Mean of 165 Student Responses	Comparison of Perceptions Between the Vertical and Horizontal Integration
	FACTOR 1 Student learning satisfaction	3.49	3.60	3.54	0.313
Q 1	The introduction of Path & Lab content in this module facilitates my learning	3.51	3.91	3.72	
Q 2	The introduction of Path & Lab content in this module helps me understand concepts of basic pathological processes in relation to their normal anatomy and physiology	3.65	3.82	3.74	
Q 3	The integration of Path & Lab content in this module helps me construct meaning into the link of pathological processes from the normal to the diseased states	3.80	3.84	3.82	
Q4	I am satisfied with the integration of Path & Lab content in this module	3.35	3.49	3.42	
Q5	This integration of Path & Lab content in this module enhanced the effectiveness of my study skills	2.90	3.10	3.00	
Q6	The integration of Path & lab content in this module helps me to understand and problem solve the case based questions in this module	3.46	3.51	3.49	
Q8	Overall I am satisfied with the organization of Path & Lab content in this module	3.50	3.60	3.55	
Q9	The integration of Path & Lab content in this module has contributed to my overall educational growth and development	3.48	3.67	3.58	
Q10	The integration of Path & Lab content in this module has facilitated enhancement of my analytical thinking skills	3.51	3.73	3.62	
Q11	The integration of Path & Lab content in this module is an effective use of my class time	3.84	3.62	3.73	
Q12	The integration of Path & Lab content in this module has contributed to my learning	3.73	3.56	3.65	
Q15	The learning climate of the classroom in this module is positive	4.00	4.11	4.05	
Q18	The integration of Path & Lab content in this module enhances my motivation to learn	3.13	3.33	3.23	
Q33	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module used a variety of learning strategies that work for me	3.48	3.35	3.41	

Q34	I am rarely bored in this interdisciplinary learning environment	2.80	3.56	3.19	
Q36	I feel the multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) is preparing me well for my profession	3.56	3.54	3.55	
Q37	I feel comfortable in the classroom learning environment of this module	3.80	4.38	4.10	
Q40	I find multi-integrated classroom experience stimulating	3.31	3.60	3.46	
Q41	The classroom teaching styles in this module encourage me to be an active participant in my learning	3.19	3.48	3.34	
Q42	The multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) has shown me how much of what I learn today seems relevant to my future training for a future career in health care	3.28	3.69	3.49	
Q46	Overall I have learned with understanding a great deal in this multidisciplinary integrated module	3.74	3.72	3.73	
Q47	I consider what I learned in this multidisciplinary integrated module to be valuable to my future training for a career in health care	3.60	3.82	3.72	
Q48	Overall I am satisfied with the quality of Path & Lab content in this multidisciplinary integrated module	3.58	3.69	3.63	
	FACTOR 2 Analytical learning	3.69	3.60	3.64	0.384
Q21	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages my independent study	3.84	3.64	3.73	
Q22	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) provides me with opportunities for interpersonal learning activities	3.69	3.39	3.53	
Q23	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to reflect on how I am learning	3.38	3.65	3.52	
Q24	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages reflection on the content material discussed	3.76	3.48	3.62	
Q25	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to question what I hear in lectures	3.53	3.39	3.45	
Q26	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to relate ideas in one subject to another	4.20	3.84	4.01	
Q27	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.24	3.58	3.41	
Q36	I feel the multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) is preparing me well for my profession	3.56	3.54	3.55	
Q45	The multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology) teaching has helped me to recognize the relationship within and between the various disciplines	4.01	3.62	3.81	
	FACTOR 3 Focus clarity integration	3.42	3.51	3.47	0.400

Q29	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) is NOT well integrated	2.84	2.61	2.72	
Q32	There are opportunities for teaching staff to provide helpful feedback in this multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module	3.28	3.29	3.28	
Q35	The teaching in the integrated curriculum is well focused	3.27	3.45	3.36	
Q39	The contact teaching time in this multidisciplinary integrated module is utilized effectively	3.23	3.61	3.42	
Q41	The classroom teaching styles in this module encourage me to be an active participant in my learning	3.19	3.48	3.34	
Q45	The multidisciplinary integrated (anatomy, physiology, embryology, histology, pathology) teaching has helped me to recognize the relationship within and between the various disciplines	4.01	3.62	3.81	
Q46	Overall I have learned with understanding a great deal in this multidisciplinary integrated module	3.74	3.72	3.73	
	FACTOR 4 Student stress	2.81	3.04	2.93	0.077
Q16	I found the workload related to the Path & Lab component to be stressful	2.39	2.77	2.58	
Q28	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) promotes rote memorization of important facts (memorization by repetition without comprehension)	2.89	3.09	2.99	
Q44	I find that multidisciplinary curriculum has increased my stress load	3.13	3.26	3.20	
	FACTOR 5 Student independence learning	3.13	3.27	3.20	0.233
Q30	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) has facilitated the move from time spent in formal class to time spent in independent study	3.21	3.50	3.36	
Q31	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) has provided an opportunity for the choice of the schoolwork to be done	2.94	2.99	2.96	
Q32	There are opportunities for teaching staff to provide helpful feedback in this multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) module	3.28	3.29	3.28	
	FACTOR 6 Student reflection and interaction	3.34	3.81	3.58	**0.000*** **
Q23	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to reflect on how I am learning	3.38	3.65	3.52	
Q27	Multidisciplinary integration (anatomy, physiology, embryology, histology, pathology) encourages me to be cautious about drawing conclusions unless they are well supported by evidence	3.24	3.58	3.41	
Q43	Multidisciplinary integrated teaching has facilitated me to interact easily with other students in my class	3.40	4.20	3.81	

	FACTOR 7 Student engagement	3.05	3.62	3.34	**0.000*** **
Q17	Integrated Path & Lab content in this module is moving toward being learning centered rather than being content centered	3.20	3.44	3.32	
Q19	The integration of Path & Lab content in this module encourages the student engagement in the classroom	3.01	3.71	3.37	
Q20	Integration of the Path and lab content in this module encourages active learning opportunities (in class questions, discussion, group activities)	2.95	3.72	3.35	
	FACTOR 8 Goals, objectives, and knowledge	3.71	3.90	3.81	0.104
Q7	The path & lab content in this module emphasizes application of knowledge rather than simple recall of factual knowledge	3.78	3.89	3.84	
Q13	There were clear goals and objectives for Path & Lab content in this module	3.46	3.75	3.61	
Q14	The exam questions for the Path & Lab content in this module were matched to their goals and objectives	3.58	3.87	3.73	
	FACTOR 9 Student learning environment	3.84	4.09	3.97	0.371
Q15	The learning climate of the classroom in this module is positive	4.00	4.11	4.05	
Q37	I feel comfortable in the classroom learning environment of this module	3.80	4.38	4.10	
Q38	The atmosphere is relaxed during the lectures in this module	3.89	3.80	3.84	
	FACTOR 10 Vocational relevance	3.42	3.61	3.52	0.247
Q36	I feel the multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) is preparing me well for my profession	3.56	3.54	3.55	
Q42	The multidisciplinary integration approach (anatomy, physiology, embryology, histology, pathology) has shown me how much of what I learn today seems relevant to my future training for a future career in health care	3.28	3.69	3.49	
Q47	I consider what I learned in this multidisciplinary integrated module to be valuable to my future training for a career in health care	3.60	3.82	3.72	
Q48	Overall I am satisfied with the quality of Path & Lab content in this multidisciplinary integrated module	3.58	3.69	3.63	

Appendix 4.6. **Focus Group Interviews –First year medical and dental students**

Integration focus group: first-year medicine and dentistry, 11 April 07

What is integration?

- Willingness to communicate among teachers/profs; collaboration
- Specialties work together
- More efficiency in education; goes more smoothly, quicker; practical with less time wasted due to repetition
- Each teacher knows what the others are doing; they build off and complement each other
- Refer to each others' work/teaching
- Don't have to repeat the simple stuff
- Vertical: don't know what's needed for next year; horizontal seems OK
- Create connections, new perspectives; there has been some ambiguity

What integration did you notice in Pathology teaching?

- Dr. Kanthan refers to what others have taught and sits in on some other lectures (though there is not much the other way – people sitting in on Path teaching)
- Dr. Kanthan comes to F&F classes and teaches related material
    - Clinical info/context; intro to next year i.e. shock
- Cell necrosis (Path) did not seem related to other classes at the time (F&F)
- There was some repetition in neuron and less in F&F
    - Three different profs gave different names to structures in F&F; confusing
    - Blood beta cells disagreement was resolved between the two profs then explained later to the class

How is integration helpful to learning?

- Reinforces other aspects from other courses; what's important in physiology
- Time management, efficient without the repetition
- Makes connections
- Better to go from the simple to the complex
- Integration module in F&F is good
- Getting the same thing at the same time so disciples reinforce each other (physio reinforces anatomy etc)
- Knowing the path helps reinforce the normal

Suggestions for more/better integration

- Show the pathology-histo connection (not having to recognize path slides but seeing path beside normal)
- Less repetition and more communication so able to spend more time on the complex topics

- Put Path at the end of each module
- Spread out the topics; with cancer once a week there's time to let it sink in, rather than getting it all at once and then never revisiting till second year
- Is important should be tested, sometimes separately
- Instead of or in addition to the final integrative module do some little integration at the end of each module or cluster of modules
- More integrative cases and these could have some path questions/aspects
- Pathology could be started earlier in the year with simpler material
- For the integration module at the end of the course, let us work in small groups on more cases rather than telling us more (lectures) like the integrated cases.

Appendix 4.7. Focus group Interviews – Second year medical students -A

Focus group, 4 April 2007

What does integration look like? What is it?

- Information in one course is related to and the same as in other courses
- Common themes
- Continuity, not disjointed
- Not repeated/overlap; different points of view/ways of looking at something
- Better spectrum, view of a topic

What do you notice about the integration of pathology?

- Good with systems, micro and path are also well integrated
- Look at same word/disease/topic within a few days
- Different, broader perspectives – systems is clinical presentation and treatment, path is disease process, labs, tests, some diagnosis of common and classic conditions, micro is treatment, clinical, lab, pathogens, practical with cases, diagnosis, dosages, orders

In what ways does the pathology integration help you to learn?

- Reinforces, answers different questions, complements learning in other subjects in different ways
- Connects back to what we already learned
- Helps me to understand and not just memorize (i.e. prescriptions)
- Hep C: goes over every aspect, knowing why not just what to do
- Not initegrated: CV drugs in pharmacology were one semester late
    - Did not know why for drugs because no pharmacology
    - Helped me review systems; still better to have at the same time
    - lots of repetition (especially physiology which was not needed)
- path and micro – why and what's going on, how to order tests.

Suggestions for greater integration

- quite happy, memorization is bad so like integration
- sometimes assumed topic covered in Systems but was not so more talk among instructors and between subjects
- lots of 1st year path comes up in 2nd year and wish we had learned more then
    - 1st year was too much information at the time but it was more important than we thought at the time

Appendix 4.8. Focus group Interviews – Second year Medical students-B

Focus group, 2 May 07

What does integration look like? What is it?

- Teachers knowing what other teachers are doing in the same topic; aware of what's being taught
- Taking important concepts of Path and applying them in Systems
- Different perspectives on the same concepts
- In Hematology the teachers knew what was going on but in Cardio they did not; neuro and ophtho were reversed
- Integration avoids redundancy, emphasizes key concepts, gives different perspectives on the same topic
- They become complementary, helpful for one another, work with each other
- Sometimes courses are not connected

What do you notice about the integration of pathology?

- Hematology was the best so far, the others don't seem to flow as well: in the others each course (Path and Pharm) seems to re-teach systems and then get into the newe stuff
- Dr. Saxena gives an approach, along a time line, and how Path is integrated into the order of events; the context makes it relevant and more motivating; dermatology was OK too
- The courses are being taught more or less at the same time; Path instructors ask what we know and would like to learn
- The clinical cases are good and integrate with Systems

In what ways does the pathology integration help you to learn?

- Easier to study and understand and to identify the important core concepts; get the overall picture
- More interesting when I see how it fits into the clinician's world and see how it applies
- I understand better, otherwise they are just words to memorize, that I forget after the exam; when integrated I see where they fit in and understand the whole thing

Suggestions for greater integration

- Even with temporal integration (student term) there needs to be similar emphasis; it's contradictory and unsettling when Systems devotes much less time to a condition than Path or Pharm (and vice versa).
- Organize the sessions similarly according to a common rubric or approach, maybe broad categories

- In Micro we learn how to order labs work and reports, to do stuff; in Path I'm not sure how to get and read reports (or how to order genetics tests)
- Get one person in Path, Pharm, Systems all connected to one system and hammer out a schedule
- Do the first principles of pharmacology in first year so that in 2nd and 3rd years Pharm can follow Systems more closely
- Learn to read Path Labe reports, make it more practical, I have knowledge but can't use it
- Use Path reports in the clinical cases
- An ideal approach would be to have Systems lay out the clinical framework in the morning them Path and Pharm add their related parts later that same day