STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY:
AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC
EXPERIENCE

by

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the degree of Doctor of Philosophy

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dedication

to Joey,
my best friend -
you are the compass to my map
Abstract

Anatomy education is challenged to develop contemporary approaches to teaching and learning that move beyond factual recall to elicit from students meaningful and deep understandings of the discipline. Inquiry-based learning is one such pedagogy that involves students’ active and increasingly independent investigation of questions and problems that are of interest to them. Because inquiry-based learning aims to encourage learners to draw upon wider contexts for learning and emphasizes the development of skills that extend beyond the confines of the classroom, there is a potential that students’ experiences are authentic in nature. This study sought to explore undergraduate students’ experiences of an Inquiry Project for learning anatomy. The project’s aims were twofold. First, to document, describe, and explain the essence of students’ experiences of engagement throughout the Inquiry Project, and second, to explore students’ experiences as potentially reflective of authentic learning.

A hermeneutic phenomenology and case study methodology was used to explore students’ experiences of an Inquiry Project within a second-year undergraduate anatomy course at a mid-sized university in Ontario, Canada. Students (18) and facilitators (3) were observed during group work sessions and inquiry presentations, curricular documents and students’ work were analyzed, and interviews were conducted. Data analysis sought to describe students’ experiences and as a result, common meaningful themes of groups’ and students’ engagement were characterized. These results were then further analyzed through a theoretical framework of authentic learning, informed mainly by the Theory of Authentic Learning. While confirmatory and novel connections between factors were found to reflect Authentic Learning, five qualities of Authentic Inquiry Learning emerged from analysis of the data to represent how students’ learning was neither solely authentic nor inquiry-based, but a hybrid of the two. Authentic Inquiry Learning in anatomy education is characterized as the construction of knowledge through a
process of disciplined inquiry in a way that gets students engaged in authentic scientific inquiry that draws upon their identities as a way of making sense of and applying anatomical understandings.
Acknowledgements

Set your standards high, you deserve the best.
Try for what you want, and never settle for less.

Jillian K. Hunt

At some point along this academic journey, I received a piece of art with the above quote as a gift from my Mom. The quote has served as a mantra, and the piece of art a reminder - of the support and love that lie at the very foundation of my relationship with my Mom and Dad. No PhD is completed without extraordinary support from an incredible collection of people. My gratitude is first owed to my parents. Thank you for everything you have done to raise me as the curious, geeky, lifelong learner with the persistence to aim for what I want and settle for nothing less. My parents are one part of a wider constellation of family who shape the backbone of my existence. Thank you to the DeMeester, Struther, and Anstey families for all your support over the years: my sister Alli, my Grandparents, my Godmother Marg, my Aunts, Uncles, & Cousins, Ford, Christine, & Krystal Anstey.

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_I would maintain that thanks is the highest form of thought; and that gratitude is happiness doubled by wonder – G. K. Chesterton._
Statement of Originality

I hereby certify that all of the work described within this thesis is the original work of the author. Any published (or unpublished) ideas and/or techniques from the work of others are fully acknowledged in accordance with the standard referencing practices.

Lauren M. Anstey

(March, 2016)
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Chapter 1

Introduction

What does it look like when learning is authentic? What are students’ learning experiences like when personal interests serve as a point of inquiry for learning? This study explores critical questions such as these for undergraduate anatomy education. This first chapter further introduces the context of this study. It presents a statement of the problem, a declaration of the purpose of the study, and the research questions posed. Further, it offers an autobiographical sketch of my position as a researcher and concludes with an overview of this thesis’ organizational structure.

Context of Study

Progressively, post-secondary education has recognized the importance of student-centered learning that is both active and engaging (Michael, 2006). This perspective is reflected in theoretical and practical considerations alike. Constructivist theories of learning include active learning as a central tenant. Based on the work of Piaget and Vygotsky, constructivist learning theory has two basic premises: (1) that learning begins at the intersection of knowledge, attitudes, and interests that students bring to a learning situation, and (2) that learners construct their own understandings from within themselves (Howe & Berv, 2000). From these tenants, it is believed that learners “(1) construct [their] own knowledge and meaning largely (2) through active engagement and inquiry (3) with other people (4) in real-world contexts, (5) building on [their] prior knowledge and experience” (Lee, 2007, p. 14).

Practical considerations of teaching and learning also consider active learning to be an integral component. Chickering and Gamson’s (1987, 1991) principles of good practice in undergraduate education place emphasis on active learning as a necessary process that keeps students mentally and physically involved in their learning through activities that require the...
application and use of knowledge. Furthermore, active learning is reflected in newly designed Degree Level Expectations (DLEs), a standardized framework for defining and qualifying post-secondary education currently being introduced provincially and nationally (Ontario Council of Academic Vice-Presidents [OCAV], 2005). DLEs see the purpose of undergraduate education as not simply obtaining knowledge, but rather as the active participation and formation knowledge through doing. Undergraduate students are expected not only to develop a critical understanding of key concepts, perspectives, methodologies, etc., but also higher order skills such as the ability to gather, review, and interpret information; compare various viewpoints and hypotheses; and apply their learning outside of their discipline of study (OCAV, 2005).

The discipline of anatomy is challenged to meet these developing expectations of teaching and learning. Concerned with describing the form and function of the human body, the study of anatomy is thought to be essential in understanding human performance, health investigation, and clinical intervention. Anatomy is commonly taught at the post-secondary level to a variety of professional students such as those in medical, nursing, physiotherapy, and occupational therapy. In a traditional medical curriculum, the gross anatomy course typically serves as the “threshold experience at the beginning of [the medical student’s] curriculum” orienting students to the structure and design of the human body (Bender, 2010 p. 1179). In other professional programs such as nursing, physiotherapy, and occupational therapy, anatomy courses often serve to link clinical practice and procedure to the human structure.

Statement of the Problem

While traditionally tied to a professional context of practice, anatomy courses have been increasingly offered at the pre-professional undergraduate level to a variety of students such as those in health sciences, basic sciences, and biology disciplines. Many of the undergraduate students who enroll in such courses classify themselves as “pre-med” or “pre-professional”, in other words, they study with aspirations to enter professional programs such as medical school,
physiotherapy, occupational therapy, etc. Undergraduate anatomy courses such as these tend to teach general anatomy, that is, they teach understandings of the anatomical body that are not tied to any one particular professional practice.

No matter the audience, anatomy courses have traditionally consisted of didactic lectures that present a myriad of anatomical terms to students (Marx, Honeycutt, Clayton, & Moreno, 2006; Sugand, Abrahams, & Khurana, 2010), and have treated content as being external to the learner – there to be discovered and mastered. Students often approach this material with surface learning techniques, that is, techniques that encourage rote learning and knowledge of disconnected facts (Biggs & Tang, 2003). For example, Pandey and Zimitat (2006) characterized medical students’ approaches to learning anatomy as relying heavily on strategies such as memorization, mnemonics, and repetition to learn the material. Traditional approaches to anatomy education may meet expectations surrounding the development of critical understandings of key concepts, yet may fail to encourage higher order thinking and action skills such as those as outlined in undergraduate DLEs.

As an anatomist, I see how the structure and function of our bodies interweaves and mediates all that we experience, feel, and do each day. Yet, as demonstrated above, the majority of students who will learn anatomy often come to see the discipline as an ancient science of disconnected terms and facts to be memorized, recognized, and forgotten. Thus, the discipline is challenged to develop contemporary approaches to teaching and learning with an aim to move beyond factual recall to elicit from students meaningful and deep understandings of the discipline (Hermiz, O’Sullivan, Lujan & DiCarlo, 2011). Anatomy educators who have shifted their pedagogical approaches have adopted a range of contemporary pedagogies such as problem-based learning (Cowin et al., 2010; Langlois et al., 2009), case-based learning (McBride & Prayson, 2008; Parmar & Rathinam, 2011), inquiry-based learning (Brown, 2010; Chaplin, 2003; Lee, Anstey, & MacKenzie, 2012), and team-based learning (Hoon Kang, Shin, & Hang, 2011).
Overall, these pedagogies aim to extend learning beyond the content itself by providing a wider context for knowledge application; each promote the development of wider skills such as critical thinking and lifelong learning skills.

Inquiry-based learning (IBL) is one such pedagogy that involves students’ active and increasingly independent investigation of questions and problems that are of interest to them (Dewey, 1938; Lee, Greene, Odom, Schechter, & Slatta, 2004). IBL involves increasingly independent investigation of complex questions and problems (Lee et al., 2004). Learning is centered upon a process of scientific inquiry and students learn as they form ideas, act upon them, observe conditions, and organize facts for future use. As students take on increasing responsibility for forming and posing their own questions, they draw upon those everyday experiences having immediate and long-term relevance to them (Dewey, 1938).

Utilized in the undergraduate anatomy classroom, IBL has been found to facilitate deep learning (Lee et al., 2012), improve examination performance (Brown, 2010), strengthen learner satisfaction (Hermiz et al., 2011), and encourage higher levels of engagement and interest in the discipline (Chapin, 2003; Meuler, 2008). Overall, IBL is considered a valuable contemporary approach to anatomy education because of the way it stimulates learners to be active participants in the scientific investigation of the discipline. Learners move beyond memorization of terms to investigate anatomical concepts in relation to a wider context. When engaged in inquiry learning, learners themselves are made responsible for interpreting, incorporating, and connecting information, and are challenged to generate solutions by utilizing process skills (Svinicki, 1998; Harwood, 2003).

Because IBL aims to encourage learners to draw upon wider contexts for learning and emphasizes the development of skills that extend beyond the confines of the classroom, there is a potential that students’ experiences are authentic in nature. *A Theory of Authentic Learning* (Hill & Smith, 1998; 2003; 2005a, 2005b; Hill, Anstey, Gallinger, & Penn, 2013) acknowledges the
need for learners to orient and constitute meanings from contexts that align with their personal histories, beliefs, and perceptions, and to connect learning in school to the world beyond the classroom. In an authentic learning environment the cognitive, physical, and interpersonal demands of the learning task are congruent with those of real-life (Hill & Smith, 2005a; Savery & Duffy, 1995). As opposed to the presentation of abstract and decontextualized concepts that have little relevance to students’ lives, authentic environments link learning and context together (Hill & Smith, 2005b). Tasks, activities, and assessments result in achievement that is significant and meaningful rather than trivial and inapplicable (Knobloch, 2003; Newmann & Wehlage, 1993). An inquiry-based anatomy curriculum might, therefore, engage learners to explore the complex nature of the human structure in contexts of their everyday experiences, feelings, and understandings.

Research on IBL has been limited to description of the approach as enacted within the classroom and to accounts of students’ attitudes towards IBL. While approaches have been adequately described in the literature, oftentimes research has failed to adequately measure or describe the impact of such an approach on students’ learning experiences (Sproken-Smith, Walker, Batchelor, O’Steen, & Angelo, 2012). Based on current literature, (1) it is unclear as to what student’s experiences of learning anatomy through an IBL are like, and (2) there are no investigations as to whether the learning experience of IBL can be characterized as an authentic learning experience.

**Purpose and Research Questions**

The purpose of this research is twofold: (1) to explore, document, and explain students’ experiences of an IBL curriculum for learning human anatomy, and (2) to ask whether these experiences represent an authentic learning environment. Specifically, this research sought to answer two main questions and their subsidiaries:
1. How do students’ experience their learning of anatomy through an inquiry-based learning curriculum?
   - What are the lived educational experiences of undergraduate students participating in the Inquiry Project?
   - What is the learning experience like for students learning anatomy through Inquiry? How can students’ experiences be explained or characterized?

2. Is the essence of the learning experience reflective of authentic learning? And if so, how?

In addressing the first question, the nature of students’ learning was studied as experienced and described by them. Next, these experiences were compared to a theoretical framework of authentic learning to determine if learning experiences could be characterized as authentic and if so, how this characterization might be explained.

Rationale

Given that IBL is considered a contemporary pedagogy in anatomy education, there is a void in the literature with regard to students’ learning experiences in this context. There is also a void with regard to the ways in which anatomy education might engage students’ motivations and personal meaning making through authentic learning environments.

This research aims to contribute to the advancement of anatomy education by providing research results through which student meaning-making within the context of novel pedagogical approaches can be understood. This knowledge is timely as this field struggles to move from didactic, passive, and surface approaches, to offer active, deep, and contextualized discovery of anatomical knowledge. In addition, the methodology used in this study contributes to research approaches in anatomy education. To date, publications in the field of anatomical sciences education have been largely anecdotal in nature (Vorstenbosch, Bolhuis, van Kuppeveld, Kooloos, & Laan, 2011) and qualitative methodologies such as the case study design proposed
here have rarely been utilized (Sproken-Smith et al., 2012). Therefore, this research employs an under-utilized methodology to investigate a novel and exemplary curriculum.

Further, the research adds to an understanding of authentic learning. While authentic learning has been framed as a valuable practice for higher education, little research has been conducted on undergraduate students’ experiences in classrooms, especially anatomy (Knobloch, 2003; Newmann & Wehlage, 1993; Herrington & Herrington, 2005). With a better understanding of how authentic learning is reflected in various educational contexts – including different disciplines and academic levels of study – educators will be better enabled to create classroom environments that facilitate meaningful and contextualized learning experiences for their students.

**Autobiographical Signature**

What follows is an autobiographical signature that seeks to illuminate and draw upon my interests and how they play a role in my perspective as researcher. First, my interests in learning in general arise from personal experience. Since a young age, I have been positively rewarded and gratified by academic success. Through my studies, I have come to recognize the difference between powerfully influential teaching and stale, disengaging didacticism; between highly engaged, inquisitive learning and the blank stare of apathetic faces. The more I notice my own growth, I note that I lean more heavily toward a preference for the influential, engaged, and inquisitive - to which I attribute having a freedom to explore and forge my own path in knowing. I view teaching and learning that upholds these values in high regard, and respond positively to teachers and students who take such approaches.

Secondly, my research activities have fostered my interests in IBL and authentic learning. Since my undergraduate studies, I have been attracted to research projects that investigate forms of learning such as peer-based learning, problem-based learning, and authentic learning. As a past employee at an anatomy lab of a post-secondary institution in Ontario, I both engaged in and
investigated anatomy education through cadaver labs that used IBL and PBL approaches. As a post-secondary student, I have watched the development of IBL in application to undergraduate anatomy education and have contributed to its growth by acting as a curriculum developer for related project.

Finally, my life is further shaped by the fact that I am a white, heterosexual, cisgender, Canadian woman, who has a strong sense of community and belonging to my international, national, provincial, and local worlds. My appreciation and understanding of the multi-cultural comes from my place within Canadian culture. Although I sense I lack racist or strongly stereotypical views, I know that in some form, they inherently exist.

**Organization of this Thesis**

Chapter 2 presents a review of the literature pertaining to inquiry-based learning, authentic learning, and undergraduate anatomy education. Chapter 3 outlines the methodology and methods employed in this study. The chapter also describes case study context researched – a group-based Inquiry Project that was part of a second-year undergraduate anatomy curriculum. Chapters 4 through 7 present the results of this study. Chapter 4 focuses on students’ experiences of learning before engagement in the project, and describes how students were introduced to the project. Chapters 5, 6, and 7 focus on describing the experiences of three Inquiry groups as they engaged in the project. Chapter 8 consolidates this description into common meaningful themes of group and student experiences. Chapter 9 then discusses these themes in context of a theoretical framework of authentic learning. Finally, Chapter 10 offers conclusions and final considerations.
Chapter 2

Literature Review and Theoretical Framework

Three key areas related to this study are explored in this literature review chapter, and include: (1) inquiry-based learning, (2) authentic learning, and (3) anatomy education. This literature review begins by exploring inquiry-based learning and authentic learning respectively. Definitions and historical origins are detailed, and the various ways in which each are represented within the literature through models and frameworks are presented. Particular consideration is given to the Theory of Authentic Learning (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill & et al., 2013) as the theoretical framework of this study. The final element of this literature review is a consideration of anatomy education. First, the historical contexts of the discipline are considered. Secondly, what is known of students’ approaches to learning anatomy is discussed. Finally, contemporary pedagogies utilized to address the many challenges of teaching and learning within the discipline are summarized.

Inquiry-Based Learning

Inquiry-based teaching and learning in higher education is widely recognized, advocated for, and utilized in a variety of disciplines. Inquiry-based learning (IBL, sometimes also referred to as inquiry-guided learning or enquiry learning) refers to a wide range of strategies and practices that promote learning through question- or problem-driven investigation. While questions and problems lie at the heart of inquiry-based pedagogy, no universal definition for IBL exists, nor is there a single formula or universal model for its implementation or practice. Widely accepted definitions of IBL highlight its broad nature. Lee et al. (2004) stated, “inquiry-based learning (IBL) refers to an array of classroom practices that promote student learning through guided and, increasingly, independent investigation of complex questions and problems, often for which there is no single answer” (p. 9). In an effort to capture the relationship between
scientific inquiry and inquiry learning, other definitions describe a process of learning based on
the practice of scientific investigation. Justice et al. (2001) described IBL as “an orientation to
learning that is open and flexible, in which faculty and students are co-learners who guide and
facilitate the student-driven learning experience, emphasizing the development of complex
questions, critical thinking and assumption of responsibility” (p. 4). Further, Cartsens and
Bernstein Howell (2012) defined IBL by listing components of the learning process:

IBL is a range of activities that have in common the student’s central role who actively
takes charge of his or her learning, raising questions, challenging pre-packaged answers,
seeking out necessary information, weighing different perspectives against one another
and making real choices about what to believe and what to do (p. 53).

Many researchers (Sproken-Smith & Walker, 2010; Abrams, Southerland, & Evans 2008; Justice
et al., 2007; Eick, Meadows, & Balkcom, 2005; Kahn & O’Rourke, 2004; Committee on the
Development of an Addendum to the National Science Education Standards on Scientific Inquiry,
Centre for Science, Mathematics, and Engineering Education, and National Research Council,
2000; Weaver, 1989) are in agreement that, despite these various definitions, core ingredients or
basic elements of IBL exist that include: learning as driven by questions; learning as occurring
through the engagement of scientific inquiry; learning as student-centered activity where the role
of the teacher is to serve as a facilitator; learning as a process of constructing knowledge and new
understandings; and learning as an active and increasingly independent activity.

Various definitions result from the wide diversity of characteristics arising from learning
environments that have been identified as inquiry-based. Such diversity was captured by
Aditomo, Goodyear, Bluic, and Ellis (2013) who described five key dimensions of IBL: scale,
level of structure, student-centeredness, forms of activity, and learning goals as displayed in
Figure 2.1.
The dimension of *scale* refers to the length or size of an inquiry activity. An inquiry task can range from being contained to a single session or teaching event, to being an ongoing task spread across multiple sessions (i.e. across a course or term), to being program- or degree-wide. An example of a small-scale inquiry session would be the incorporation of a single, one-off inquiry activity into a class, as Brown (2010) described. In contrast, the ecology program at the University of Otago serves as an example of a degree-wide inquiry where the core of the program consists of four courses designed to progressively develop skills through increasingly independent inquiry across multiple years of study (O’Steen & Sproken-Smith, 2012).

The dimension, *level of structure*, refers to the degree of organization or instruction that is provided to students as they engage in an inquiry activity. Early advocates of IBL such as
Schwab (1964) and Herron (1971), described an increasing degree of openness to inquiry learning, where an inquiry activity could be categorized as structured, guided, or open. A structured inquiry activity scaffolds the entire inquiry process from posing specific problems/questions, to describing the means for investigation, and the potential solutions reached. A guided activity, however, only partially scaffolds the process. For example, problems or questions may be posed but the methods for discovery and answers reached are left open to the students’ actions and interpretations. Finally, in an open activity “the student is confronted with the raw phenomenon” (Schwab, 1964, p.55) of inquiry where they take on responsibility for devising the question, methods, and answers with very little guidance or structure.

The dimension of student-centredness takes into account the role of the learner. At one end of the spectrum, a learner engages in the inquiry activity as a passive observer. At the opposite end, the learner directly engages in the activity as a participant. Closely related to student-centeredness is the dimension, focus of activity, which takes into account the objective or goal of the inquiry activity. This dimension draws upon four categories: research-led, research-oriented, research-tutored, and research-based activity (Griffiths, 2004; Healey, 2005; Healey & Jenkins, 2009). In research-led and research-oriented inquiry activities, students are observers of the instructor’s engagement in research-oriented teaching. In research-led activity, the curriculum is informed and shaped by the instructor’s own research interests. For example, students are exposed to research findings when the instructor refers to his/her research in lecture, or when research outputs are incorporated into class readings. In research-oriented activity, “the curriculum places emphasis as much on understanding the processes by which knowledge is produced in the field as on learning the codified knowledge that has been achieved” (Griffiths, 2004, p. 722). Students are exposed not only to findings and results but also to the methodologies and methods considered valuable for the production of knowledge.
In research-tutored and research-based activities, students participate directly as co-inquirers. In research-tutored activity students are facilitated to actively think about and discuss current research, methods, and findings. While students are directly involved, the learning is more conversation-based than action-based. Finally, research-based activities are characterized as the performance of research and investigation for learning. Less emphasis is placed on the acquisition of subject knowledge and instead the curriculum is largely designed around inquiry activities that engage students in problem-solving, critical analysis, data collection, and communicating findings. Overall, the four levels of research-led, research-oriented, research-tutored, and research-based activity help to qualify the dimensions of both student-centeredness and focus.

The final dimension of learning goal draws upon the work of Levy and Pertrulis (2012) and Levy (2011) who identify two potential goals of inquiry – to either locate existing knowledge or to develop novel knowledge on a question or problem. Levy (2011) make a further distinction between the source of the question or problem – the instructor can pose a question/problem, or students can develop a question arising from their own interests and curiosities. Overall, four modes of inquiry are created by combining the two potential goals with the two potential sources: (1) in an identifying mode, the goal of inquiry to locate existing knowledge upon a question/problem that is posed by the instructor; (2) in a producing mode, the goal is to locate existing knowledge upon a question/problem that is posed by the students themselves; (3) in a pursuing mode, the goal of the inquiry is to develop novel knowledge upon a question/problem posed by the instructor; and (4), in an authoring mode the goal is to develop novel knowledge upon a question/problem as posed by the students themselves.

These five dimensions—scale, level of structure, student-centredness, focus of activity, and learning goal—serve as an organizational framework for orienting various definitions of IBL arising from the literature. No single definition can capture the full breadth of all activity considered to be inquiry-based, but these key
dimensions and understandings help to unite diverse iterations. Based on these elements, Aditomo et al. (2013) investigated the principle forms of learning tasks that university instructors considered to be inquiry-based, and pose nine forms of IBL, which are summarized in Table 2.1.
Table 2.1.

**Forms of IBL**

<table>
<thead>
<tr>
<th>IBL Form</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarly Research</td>
<td>These tasks require students to formulate questions (although the broad topic may be given by the instructor) and to collect the empirical data to address those questions. These tasks are closest to the kinds of research in which academics typically engage.</td>
</tr>
<tr>
<td>Simplified Research</td>
<td>These tasks are simplified or narrower versions of Scholarly Research. The tasks mimic research that academics typically conduct, but students are only required to perform some aspects of the data collection and analysis. The research questions are pre-specified, and methods and analytic frameworks are usually provided through associated lectures and/or readings.</td>
</tr>
<tr>
<td>Literature-based Inquiry</td>
<td>As its name suggests, these tasks require students to conduct a review of the scientific literature pertaining to a given topic or concept. The tasks do not involve empirical data collection. The outcomes are typically reported in a written form, but sometimes students are simply asked to verbally present their literature review results.</td>
</tr>
<tr>
<td>Discussion-based Inquiry</td>
<td>Tasks that fall into this category are organized around teacher-led or group discussions. The discussions can be online or face-to-face, and can be more or less structured (e.g. the more structured tasks involve a debating script). The tasks may include students conducting independent research (e.g. a literature search), but the discussion is the organizing feature of the task.</td>
</tr>
<tr>
<td>Applied Research</td>
<td>These tasks are similar to Simplified Research in that students are required to collect some data to address questions or problems (which are typically specified or suggested by the lecturer). The difference is that Applied Research has a much more practical flavour: the outcomes of the activity are intended to address practical issues and problems.</td>
</tr>
<tr>
<td>Simulated Applied Research</td>
<td>These tasks are similar to Applied Research, in that the outcomes of the activity should address practical problems and issues. The difference is that tasks in this category present students with made-up scenarios or data, and do not require students to plan and conduct their own data collection. These tasks are often, but not always, described as ‘case-based’, or ‘problem-based’.</td>
</tr>
<tr>
<td>Enactment of Practice</td>
<td>In these tasks, students carry out inquiry in order to enact roles that are regarded as important in the relevant profession. The tasks typically require students to either provide service to real or imagined clients (e.g. education students teaching a class, medical students giving clinical consultations, etc.), or produce/create tangible artifacts (e.g. draft novels for creative writing students, lesson plans for education students, tax reports for accounting students, etc.).</td>
</tr>
<tr>
<td>Role Playing</td>
<td>Role Playing can be considered to be a specific form of Enactment of Practice. Role Playing tasks require students to provide service in a role-play situation. As with Enactment of Practice, Role Playing tasks focus on practicing skills that are part of professional roles.</td>
</tr>
<tr>
<td>Other</td>
<td>solving short quantitative problems, such as in physics</td>
</tr>
</tbody>
</table>


**Origins of IBL.** Inquiry – the process of making observations, asking questions, and pursuing investigations – is a fundamental human approach to understanding the world (Dow,
Socrates is credited as one of the first teachers to use IBL, for he used questioning to probe his students, encouraging them to critique wisdom and investigate unsolved mysteries of the natural world (Dow, 1999; Howe & Berv, 2000). IBL takes a constructivist, active, and inductive perspective on teaching and learning (Sproken-Smith, 2007). Constructivism views learning as resulting from a learner’s active construction of meanings or understandings (Phillips, 2000).

Based on the work of Piaget and Vygotsky, constructivist learning theory has two basic premises: (1) learning begins at the intersection of knowledge, attitudes, and interests that students bring to a learning situation, and (2) learners construct their own understandings from within themselves (Howe & Berv, 2000). New understandings and meanings arise from the integration of information with an individual’s prior knowledge and experience (Lee, 2007). Learning is active in the sense that learners are not perceived to be empty receptacles for knowledge transmission, but are active participants who must construe meanings through continuously updating their sense of the world. Finally, learning is inductive as opposed to deductive – learning through inquiry involves arriving at new meanings of the world by extracting them from experience (Audet, 2005).

IBL is informed by the works of Dewey, Bruner, and Schwab. In his book, Experience and Education, Dewey (1938) identified the scientific method as a valuable means for learning. Dewey suggested the process of scientific inquiry could be harnessed to help students form ideas, act upon them, observe conditions, and organize facts for future use. Through this process, students could explore and learn from those everyday experiences that have immediate and long-term relevance to them. Bruner (1966) advocated for a process of discovery where, through putting theoretical models of thinking to use, students would discover their abilities to think independently, generate good questions, and come up with interesting conclusions. Finally, Schwab (1958) believed in teaching science with a scientific outlook and argued that learners should engage in question posing, and the collection/interpretation of data.
More recently, a 1998 report on the status of undergraduate education, titled *The Boyer Commission*, boldly stated that universities were failing their undergraduate students by discounting inquiry as a valuable approach to learning. The commission concluded that learning through inquiry, rather than through the transmission of knowledge, should be a key component of an undergraduate student’s bill of rights. As a result, there is an increasing trend towards the adoption of IBL philosophies and approaches to teaching and learning in higher education. Numerous universities – particularly those with strong research and teaching values – now consider inquiry to be integral to their institutional goals and implement IBL to various degrees from discrete activities within a course to whole programs (Lee, 2012, 2013; Fowler, Matthews, Schielack, Webb, & Wu, 2012; Ako Aotearoa, 2008).

Focusing attention on Canadian and Ontario universities alone, exemplary illustrations of IBL in practice can be found. McMaster University in Hamilton, Ontario is recognized locally, nationally, and internationally for its inquiry- and problem-based curricula. The university’s Bachelor of Health Science program, for example, is entirely inquiry-based where an introductory course, titled *Inquiry Course*, sets the stage for inquiry learning throughout the degree program:

A central goal of the Inquiry Course will be to inculcate the concept of "student as active learner" throughout the entire undergraduate experience. Our undergraduates should not learn primarily as passive recipients of information, but as active participants in their education in order to better develop critical thinking and communication skills. A central goal of the Inquiry Course will be to inculcate the concept of "student as active learner" throughout the entire undergraduate experience. Our undergraduates should not learn primarily as passive recipients of information, but as active participants in their education in order to better develop critical thinking and communication skills. (McMaster University, 2013)
In other contexts, IBL is actively integrated into individual courses, seminars, and laboratories. A publication by Abiola-Ogedengbe (2011) highlights the use of IBL at Western University in London, Ontario, where an IBL approach was used within experimental laboratory sessions for undergraduate engineering students.

Additionally, IBL has been integrated into strategic and academic planning for Ontario institutions such as Queen’s University in Kingston, Ontario. The first pillar of their 2011 Academic Plan is titled “Student Learning Experience” and emphasizes an IBL philosophy:

In a research-intensive university, the student learning experience must be the experience of a researcher. A researcher has a question to be answered, a problem to be solved, a relationship to be understood, a behaviour to be analyzed, or a task to be undertaken… The basic relationship of the researcher to the problem or task is one of active inquiry, and that is the mode of learning we wish to promote among our students”. (Fachinger et al., 2011, p. 8)

**The relationship between inquiry-based learning and problem-based learning.**

Inquiry-based Learning is often considered and discussed alongside problem-based learning (PBL) and therefore a distinction between the two is worth noting here. As Lee (2013) describes, “Problem-based learning is a specific type of inquiry-guided learning that arose in fields such as medicine and engineering in which problem solving is a dominant mode of inquiry” (p. 156). PBL uses problems, such as clinical cases, as the organizing focus and stimulus for learning (Barrows, 1996; Barrows & Tamblyn, 1980) and prompts students to engage in an independent, self-directed, and peer-based process for acquiring knowledge (Schwartz, Mennin, & Webb, 2001; Wood, 2003). The problem serves as both the trigger and focus of learning, whereas, “Not all inquiry necessarily starts with a ‘problem’ in the sense that it presents problematic situations. Inquiry can begin with a question, a hypothesis, a statement, a text, a picture, a word” (Hutchings, 2007). Like IBL, PBL has its roots in the constructivist discovery-
based learning philosophies of Dewey and Bruner. However, upon its conception PBL was strongly influenced by the case method at Harvard University, which used concrete problems relevant to professional practice in the education of law and business students (Schmidt, 2012), thus inspiring the use of problems for learning.

Other differences are noted between IBL and PBL in the way that they are implemented. Roy, Kustra, and Borin (2003), for example, compare IBL and PBL on specific aspects such as initiation, duration, breadth, and depth of study. IBL is initiated with a general theme or issue while PBL is initiated with a specific scenario or problem. An IBL event typically lasts longer than a PBL event, such that an IBL project can span months with only one or two cycles of inquiry typically conducted over the length of an academic course. PBL cases, in comparison, may be explored for one class or for a few weeks. IBL and PBL differ on the final product of learning as well. For IBL, the product varies as the learner defines it with guidance from their class and facilitator. For PBL, the product is typically specific with a solution to the problem reached.

Through their comparison, Roy et al. (2003) contrast the role of the facilitator between IBL and PBL. In IBL environments, the facilitator initiates the inquiry by choosing themes or issues under examination. The facilitator may identify general content and objectives, facilitate or moderate the process of inquiry, and regularly guide a process of self and peer reflection. In PBL environments, the facilitator initiates learning by presenting a series of problems or scenarios that are intended to bring about learning in a specific area of the curriculum. They then identify objectives, facilitate exploration of the problems posed, and moderate discussion, providing feedback along the way.

Finally Roy et al. (2003) make the comparison between IBL and PBL on the basis of the questions asked by students. IBL learners develop questions, often for which there are no known
answers. PBL learners, on the other hand, identify good questions based upon the problems posed and generally seek solutions or answers that address it.

**Demonstrated benefits and criticisms of IBL.** Through inquiry learning, students have demonstrated the development of meta-cognitive skills such as critical thinking (Inouye & Flannelley, 1998; Magnussen, Isida & Itano, 2000; Holaday & Buckley, 2008), independent problem-solving ability (Madill et al., 2001), inquiry and research skills (Inouye & Flannelley, 1998; Gehring & Eastman, 2008; McKinney, 2010), observation skills and collaboration abilities (Feletti, 1993; Inouye & Flannelley, 1998).

Despite these demonstrated benefits, IBL has been challenged as a form of minimally guided teaching that fails to provide the necessary structure, guidance, and explicit information necessary for effective cognitive functioning important in learning (Kirschner, Sweller, & Clark, 2006). To be successful, inquiry-based learning environments require careful scaffolding and guidance that support students through the learning process (Hmelo-Silver, Duncan, & Chinn, 2007). In other words, IBL is not a form of minimally guided instruction but a form of carefully orchestrated facilitation. “Good facilitation,” McKinney (2010) said, “is all about giving students the confidence to approach their inquiry, that they can find things out for themselves [...] through the use of appropriate questioning and provision of support materials to discover their own path” (p. 23-24).

**Models, conceptual frameworks, and theoretical frameworks of IBL.** Throughout the literature, IBL has been represented through the presentation of various models, and frameworks (both conceptual and theoretical). In this section, these models and frameworks are explored in order to gain a richer understanding of the ways in which IBL is conceptually and theoretically structured.

**Models of IBL.** Models of the inquiry process have been developed to represent the series of steps students typically take when engaged in inquiry learning (Ai et al., 2000; Justice et
al., 2007; Committee on the Development of an Addendum to the National Science Education Standards on Scientific Inquiry, Centre for Science, Mathematics, and Engineering Education, and National Research Council, 2000). A model developed by the Committee on the Development of an Addendum to the National Science Education Standards on Scientific Inquiry; Centre for Science, Mathematics, and Engineering Education; and the National Research Council of the United States (2000) outlines five essential features of IBL and the variations that result when learning becomes increasingly student-led, and inversely, less teacher-directed (Table 2.3).

Table 2.2.

**Essential Features of Classroom Inquiry and Variables**

<table>
<thead>
<tr>
<th>Essential Feature</th>
<th>Variations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learner engages in scientifically oriented questions</td>
<td>Learner poses a question</td>
</tr>
<tr>
<td></td>
<td>Learner selects among questions, poses new questions</td>
</tr>
<tr>
<td></td>
<td>Learner sharpens or clarifies question provided by teacher, materials, or other source</td>
</tr>
<tr>
<td></td>
<td>Learner engages in question provided by teacher, materials, or other source</td>
</tr>
<tr>
<td>2. Learner gives priority to evidence in responding to questions</td>
<td>Learner determines what constitutes evidence and collects it</td>
</tr>
<tr>
<td></td>
<td>Learner directed to collect certain data</td>
</tr>
<tr>
<td></td>
<td>Learner given data and asked to analyze</td>
</tr>
<tr>
<td></td>
<td>Learner given data and told how to analyze</td>
</tr>
<tr>
<td>3. Learner formulates explanations from evidence</td>
<td>Learner formulates explanation after summarizing evidence</td>
</tr>
<tr>
<td></td>
<td>Learner guided in process of formulating explanations from evidence</td>
</tr>
<tr>
<td></td>
<td>Learner given possible ways to use evidence to formulate explanation</td>
</tr>
<tr>
<td></td>
<td>Learner provided with evidence and how to use evidence to formulate explanation</td>
</tr>
<tr>
<td>4. Learner connects explanations to scientific knowledge</td>
<td>Learner independently examines other resources and forms the links to explanations</td>
</tr>
<tr>
<td></td>
<td>Learner directed toward areas and sources of scientific knowledge</td>
</tr>
<tr>
<td></td>
<td>Learner given possible connections</td>
</tr>
<tr>
<td>5. Learner communicates and justifies explanations</td>
<td>Learner forms reasonable and logical argument to communicate explanations</td>
</tr>
<tr>
<td></td>
<td>Learner coached in development of communication</td>
</tr>
<tr>
<td></td>
<td>Learner provided broad guidelines to use sharpen communication</td>
</tr>
<tr>
<td></td>
<td>Learner given steps and procedures for communication</td>
</tr>
</tbody>
</table>

Learners take an active and increasingly independent approach to learning as they move towards posing their own questions, evaluating/explaining collected evidence, and communicating their derived arguments and conclusions.

While the model details various features of IBL, a model proposed by Ai et al. (2008) focuses on inquiry as a process. In their book, Choose Your Own Inquiry, these McMaster University undergraduate students developed a model of learning based on their own experiences (Ai et al., 2008). The IREC model (Figure 2.2) stands for Inquire, Research/Reflect, Evaluate, and Construct – which serve as four interconnecting components of the learning process.

![IREC Model](image)

*Figure 2.2. The IREC Model. From Choose your Own Inquiry! by R. Ai, M. Bhatt, S. Chevrier, R. Ciccarelli, G. Grady, V. Kumari, … H. Wong, 2008, Lanham, MD: University Press of America. Copyright 2008 by University Press of America. Reprinted with permission.*

The model demonstrates that learning is first stimulated through asking questions (inquiry), which lend themselves to investigation though the gathering of data that explains the phenomenon at hand (research/reflect). Students engage in a process of collecting and evaluating appropriate evidence and construct their knowledge through the reformulation, reexamination, and synthesis of their findings (evaluate). Finally, they relate their knowledge to formulate new questions and new inquiries (construct).
Similarly, Justice et al. (2007) also posed a model that focuses on the learning process (Figure 2.3). Oriented as a circle, this model displays IBL as a process leading to new interests and more questions.

![Figure 2.3. Inquiry Process.](image)


Similar to Ai et al.’s (2008) IREC model, Justice et al. (2007) show inquiry learning as a process of developing questions, identifying appropriate resources, and engaging in a process of assessment, synthesis, and critique. In addition, Justice et al.’s (2007) model recognizes self-reflection and self-evaluation as two central components inherent to each step of the process. Through reflection, learners consistently think about their thinking and learning becomes a transformative experience where learners refine their thinking by developing broadly applicable intellectual skills (Jenkins, 2007; Simmons, Drakeford & Hosseinpour, 2007). Overall, the three
models presented here (Ai et al., 2008; Justice et al., 2001; Committee on the Development of an Addendum to the National Science Education Standards on Scientific Inquiry, Centre for Science, Mathematics, and Engineering Education, and National Research Council, 2000) aim to symbolically represent the components, variables, and characteristics of inquiry learning. Whether capturing the essential features of IBL or organizing components into a process of learning, these models help articulate the key elements and process of the approach.

**Conceptual frameworks of IBL.** A conceptual framework of IBL moves beyond the models presented above. A conceptual framework organizes learning as a collection of conceptual modes existing along continua of practice. Presented by Levy (2011, 2012), Figure 2.4 depicts one framework, which captures the fundamental design principles, epistemic purposes, and student orientation to IBL.

![Conceptual framework of inquiry learning](image)

Two continua are represented on x and y axes: the x-axis differentiates between instructor- and student-framed inquiry, while the y-axis differentiates between the epistemic orientation. This y-axis distinguishes between IBL for learning (exploring existing knowledge) and IBL for knowledge building (constructing novel understandings). Along these two axes, four modes of inquiry are mapped – identifying, pursuing, producing, and authoring. At the level of identifying, the instructor frames an inquiry activity and the students ask, what is the existing answer or response to the question asked? Moving toward a more student-framed approach, the pursuing level gets students asking: what is the existing answer or response to my question? At the level of producing, the inquiry activity returns to being teacher-framed, however, the epistemic orientation changes to focus on the construction of new knowledge. At this stage, the students might ask: how can I answer the open-ended question posed by the instructor? Finally, when students build novel understandings from a process of student-framed inquiry, they have reached the authoring stage. Here students develop knowledge surrounding their own questions or problems, and ask: how can I answer my own open-ended question? Overall, Levy’s framework represents IBL as a collection of conceptual modes ranging along two continua of practice. As activities move from instructor- to student-framed, and from a focus on existing knowledge to constructing new knowledge, various modes emerge.

* A theoretical framework for IBL. A theoretical framework goes beyond conceptual understandings by integrating theory to pose the hypothetical circumstances or the explanatory scientific principles of a phenomenon. Recently, Lee (2013) published a theoretical framework for IBL (Figure 2.5), which she referred to as a schema of meaning-making in a community of inquirers.
The largest circle in grey represents raw experience and each of the smaller white circles within represent a person who is embedded within experience. The arrow arising from each circle indicates that person’s sense of purpose; each arrow indicates a different directionality to represent the diverse purposes and directions people have within society. The insert provides a closer look at the process of meaning-making through inquiry that is used by each person. As Lee describes (2013):

at the center is the person herself, alert, attentive, and curious; around her is the accretion of her experience represented by knowledge (K), methods (M), and values (V), which she orchestrates to make new meaning in the form of new knowledge claims and decisions, the widest ring. (p. 158)
Lee’s account of the meaning-making process draws upon the theories of Novak and Gowin (1984) and Kolb (1984) and their conceptions of learning. Novak and Gowin (1984) proposed that curiosities arise from interplay between methodological considerations (knowledge and value claims, interpretations, etc.) and theoretical/conceptual considerations (philosophy, theory, principles, concepts, etc.). Along a similar vein, Kolb understood learning as, “the creation of knowledge and meaning through the active extension and grounding of ideas and experiences in the external world and through internal reflection about the attributes of these experiences and ideas” (Kolb, 1984, p. 52). Kolb’s process of experiential learning recognizes the need for learners to move through various phases of thinking, reflection, and action for learning. In the concrete experience phase, learners directly engage in an experience for learning. In a reflective observation phase, learners reflect on and observe their experiences from many perspectives, integrating new experiences with previously-held values. In an abstract conceptualization phase, learners integrate observations with logically sound theories and knowledge. Finally, in an active experiment phase, learners engage in methods where their theories are used, decisions are made, and problems are solved (Kolb, 1984). For learning to occur, no single phase can operate in isolation from the others. In other words, learners must engage in all phases for meaningful learning to occur. Overall, Lee drew upon the works of Novak and Gowin (1984) and Kolb (1984) to develop a schema wherein a learner makes new meaning by orchestrating knowledge, methods, and values together. Lee (2013) asked: “What kinds of environments and practices prepare students to participate skillfully, responsibly, and even happily in advanced societies of inquiry? How can colleges and universities support students as they learn to integrate the knowledge, methods, and values of inquiry in the academic disciplines as ways of making meaning of experience with their own personal search for meaning and purpose?” (p. 159). To address her questions, Lee detailed the environmental characteristics that she hypothesized to support meaningful inquiry-based learning; characteristics such as
supporting independent inquiry, providing a range of opportunities for students to demonstrate and reflect upon their developing competencies, and creating opportunities for students to use their competencies in real world contexts.

**Summary of models, conceptual, and theoretical frameworks of IBL.** Each of the models and frameworks presented here emphasize the originally identified core ingredients or basic elements of IBL (learning as driven by questions; learning as occurring through the engagement of scientific inquiry; learning as student-centered activity where the role of the teacher is to serve as a facilitator; learning as a process of constructing knowledge and new understandings; and learning as an active and increasingly independent activity). Yet, one common theme appears to have eluded the above list that is nevertheless strongly present within the various models, conceptual and theoretical frameworks of IBL, and that is the role of students’ own meaning-making for learning.

In Levy’s (2011, 2012) pursuing and authoring modes, student-framed inquiry is central. In these modes, students explore or build knowledge upon a question that they have posed for themselves. In the model developed by Justice et al. (2007), inquiry begins when students take ownership of their learning and engage in a topic of interest. The emphasis Justice et al. place on self-reflection and self-evaluation throughout the inquiry process signifies the importance of students’ own perceptions and understandings as integral to the process. Finally, Lee’s schema clearly poses inquiry as a meaning-making endeavor, emphasizing the independent exploration of connections between learnt competencies and the wider world. These aspects of meaning-making, ownership, and student-framed learning relate closely to a theory of authentic learning, and so the next section of this literature review delves into authentic learning more deeply to explore its origins, orientations, and conceptual and theoretical representations, in an effort to explore this tacit quality of IBL.
**Authentic Learning**

In an authentic learning environment the cognitive, physical, and interpersonal demands of the learning task are congruent with those of real-life (Hill & Smith, 2005a; Savery & Duffy, 1995). As opposed to the presentation of abstract and decontextualized concepts that have little relevance to students’ lives, authentic environments link learning and context together (Hill & Smith, 2005b). Tasks, activities, and assessments result in achievement that is significant and meaningful rather than trivial and inapplicable (Knobloch, 2003; Newmann & Wehlage, 1993).

As Barab, Squire, and Dueber (2000) explained, learning environments are considered authentic when “there is a similarity between the structured learning activities and some meaningful context for the activity” (p. 38). Herrington and Herrington (2005) envisioned authentic learning in higher education as an ideal environment that “[engages] students in motivating and challenging activities that require collaboration and support. The tasks students do reflect the tasks seen in real professions and workplaces, and the problems they solve are complex and sustained, requiring intensive effort” (p. 2).

**Orientations toward authentic learning.** Throughout the literature, three related but distinct orientations towards authenticity exist, which are clarified next. The first orientation views authentic learning as focusing on the practices of culture, a second orientation poses authentic learning as participation in communities of practice, and a third orientation understands authentic learning as engaging students’ lived experiences.

**Authentic activities as the ordinary practices of culture.** This understanding of authenticity derives from Brown, Collins, and colleagues who developed notions of situated cognition and cognitive apprenticeship. The aim of their work was to develop a theoretical perspective of cognition and learning based on a model of apprenticeship (Herrington, 2006). In the same way that craft apprenticeship involves the transfer of skills and knowledge through observation and guided practice (Tilley, 2001), cognitive apprenticeship, they argued, could be
achieved by focusing on a “learning-through-guided-experience … on [the] cognitive and metacognitive, rather than on physical, skills and processes” (Collins, Brown, & Newman, 1987, p. 3). In other words, learners could cognitively engage in the ordinary practices of culture in order to develop skills for conscious participation and enculturation. To Brown, Collins, and Duguid (1989) authentic activities were “the ordinary practices of culture” (p. 34) and authentic learning was therefore the cognitive apprenticeship of such tasks through activities that resembled the same cognitive elements and demands of the practice itself. This orientation reflects Radinsky, Bouillion, Lento, and Gomez’s (2001) simulation model of authentic learning where learning activities aim to simulate professional practices. Radinsky et al. (2001) and Barab et al. (2000) both identify problem-based learning (PBL) as an example of a simulation model due to the way in which learners are tasked with thinking through professionally relevant problems in a way that is intended to imitate the field of practice.

**Authentic learning as participation in real communities of practice.** A similar understanding of authenticity in learning comes from Lave and Wegner’s (1991) concept of legitimate peripheral participation, which advocates for the acquisition of skills and knowledge by engaging in peripherally legitimate activities to which related skills are applicable. By peripherally legitimate, it is meant that learners participate “in the actual practice of an expert, but only to a limited degree and with limited responsibility for the ultimate product as a whole” (Lave & Wenger, 1991, p. 14). In other words, the task may resemble real-world action but it is engaged within a protected or low-stakes environment that shelters the student from the burden of full responsibility and consequence. In contrast to a simulation model, this orientation reflects more of a participatory model (Radinsky et al., 2000) where learners engage directly and productively in the target community of practice rather than being taught within separate simulated practice. This orientation is said to have ecological authenticity as learners’ tasks are embedded in ongoing activity within a niche of real-world practice. It is debated whether this form of learning can ever
be accomplished within the bounds of a classroom itself – in order to truly participate in a real
community of practice, learning must occur within the ecological niche or the real-world
environment, which only becomes simulated if brought into the classroom from the outside world
(Anderson, Reder, & Simon, 1996).

These first two orientations towards authentic learning are similar in that they situate
learning in context of a particular culture or community of practice. These orientations have
contributed to understandings of authentic learning that focus on professional and work-related
learning. For example, Herrington and Herrington (2005) envision authentic learning in higher
education as an ideal environment that, “[engages] students in motivating and challenging
activities that require collaboration and support. The learning [tasks students engage in within the
classroom] reflect the tasks seen in real professions and workplaces, and the problems they solve
are complex and sustained, requiring intensive effort” (p. 2).

However, Barab et al. (2000) identify a key concern with these forms of authentic
learning. In designing an environment intended to support authenticity “one has to come to terms
with what is meant by authentic and to whom. For example, ‘what is authentic to the teacher may
not be authentic to the student, and what is authentic to the student may not be authentic to the
teacher and neither may be considered authentic in terms of real-world communities of practice’”
(p. 38). Therefore, discussions of authenticity must consider authenticity not only in terms of the
target professional domain, but also in terms of the student’s life-world.

*Authentic learning as engaging students’ lived experience.* A third orientation toward
authentic learning argues that it is not just learning a cultural activity in some honest form that
makes a learning activity authentic, rather it is learning in accordance to one’s own interests and
learning in which one exercises personal agency that makes learning authentic (Van Oers &
Wardekker, 1999). From this orientation, learning is authentic because it engages the students’
lived experience; students are able to find meaningful connections between their current views,
experiences, and understandings within the social and disciplinary framework of study (Stein et al., 2004). As Baker and O’Neil (1994) articulated, “the task is intended to be inherently valuable to students either immediately or because they can see its long term connection to an important goal… and [learning] creates an opportunity for the integration of high quality subject matter learning into implicitly useful tasks” (p. 15).

This orientation toward authentic learning is captured within Tochon’s (2000) model of authentic learning (Figure 2.6) and occurs at the triangulated intersection of situated knowledge (the context for action), biological knowledge (the premises for action), and subject-matter knowledge (the didactic of the discipline).

![Figure 2.6. Authentic learning zone. From “When Authentic Experiences are “Enminded” to Disciplinary Genres: Crossing Biographic and Situated Knowledge” by F. V. Tochon, 2000, Learning and Instruction, 10, (p. 354). Copyright 2000 by Elsevier. Adapted with permission.](image)

At this intersection, students’ experiences and knowledge serve as a premise or foundation for orienting oneself within the didactic of the discipline (the specific lens through which a discipline frames its subject matter) within the context of situated knowledge. This orientation towards authentic learning does not contradict the previous two orientations, but adds an important dimension to what it means for learning to be considered authentic – as Barab et al. (2000) emphasized, discussions of authentic learning environments must consider what is
authentic to the community of practice or professional domain as well as what is authentic to the learners engaged within it.

**Conceptual frameworks of authentic learning.** This section explores two conceptual frameworks of authentic learning as presented within the literature. First, Herrington and colleagues (Herrington & Herrington, 2005; Herrington & Oliver, 2000) *Concepts of Authentic Learning* are considered. The framework was developed by conducting a literature review and analysis of situated learning as based upon theorists Brown, Dugand, Collins, Lave, and Wagner (Herrington, 2006) and therefore reflects an understanding of authentic learning as learning from engagement in ordinary practices of culture or real communities of practice. This framework (Table 2.3) shapes authentic learning as the product of several interlinking concepts.
<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentic Context/Authentic</td>
<td>The context needs to be all-embracing, to provide the purpose and motivation for learning, and to provide a sustained and complex learning environment that can be explored at length. Within this context, ill-defined activities have real-world relevance.</td>
</tr>
<tr>
<td>Activities</td>
<td></td>
</tr>
<tr>
<td>Access To Expert Performances/</td>
<td>The learning environment needs to provide access to expert thinking and the modeling of processes, access to learners in various levels of expertise, and access to the social periphery or the observation of real-life episodes as they occur.</td>
</tr>
<tr>
<td>Modeling</td>
<td></td>
</tr>
<tr>
<td>Multiple Roles &amp; Perspectives</td>
<td>Students are enabled to explore different perspectives, meaning it is important to enable and encourage students to explore different perspectives on the topics from various points of view, and to 'criss cross' the learning environment repeatedly.</td>
</tr>
<tr>
<td>Collaborative Construction of</td>
<td>Students mutually engage in a collaborative effort to solve problems together.</td>
</tr>
<tr>
<td>Knowledge</td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>Reflection occurs at multiple levels: metacognitively (the individual reflecting on learning), between the student and expert's performances, and socially (collaborative reflection with peers).</td>
</tr>
<tr>
<td>Articulation</td>
<td>Publically engaging in dialogue and expression of knowledge in a way that enables the formation, awareness, development and refinement of thought.</td>
</tr>
<tr>
<td>Coaching/Scaffolding</td>
<td>Collaborative learning between peers and tutors scaffolds support; students are coached through the process of learning.</td>
</tr>
<tr>
<td>Authentic Assessment</td>
<td>Learners need to be provided the opportunity to be effective performers with acquired knowledge, and to craft polished, performances or products in collaboration with others. It also requires the assessment to be seamlessly integrated with the activity, and to provide appropriate criteria for scoring varied products.</td>
</tr>
</tbody>
</table>

*Note.* Table 2.3 was devised by the author to summarize Herrington & Herrington (2005) and Herrington & Oliver (2000).

Herrington and colleagues’ work is regularly used as a framework for developing and assessing authentic learning environments online (Herrington, Oliver, & Herrington, 2007; Herrington, 2006; Herrington, Oliver, & Reeves, 2003), however, the conceptual elements can be universally applied to both online and face-to-face learning environments. Upon critical appraisal of the Herrington and colleagues’ framework its roots in the theories of Brown, Collins, and
Dugand (1989), and Lave and Wegner (1991) are clear. For example, activities have real world relevance and learners have access to expert performances and modeling. What is less clear in this conceptual framework, however, is whether or not authentic learning is understood as having a dimension that incorporates students’ lived experiences for learning. Nothing within the framework appears to emphasize the importance of students’ lifeworlds in the learning process.

Newmann and colleagues offer a second conceptual framework for authentic learning by outlining the defining features of authentic academic achievement (Newmann, Bruce, & Carmichael, 2007; Newmann & Archbald, 1992). Authentic learning, Newmann et al. (2007) posited, results when the defining features of authentic intellectual work – such as the work performed by scientists, novelists, business entrepreneurs, politicians, designers, etc. – are applied to classroom. The authors identified three criteria that identify authentic forms of academic achievement: (1) construction of knowledge (2) disciplined inquiry (3) value beyond evaluation/school.

The first criterion is that knowledge is constructed via the “organizing, interpreting, evaluating, or synthesizing [of] prior knowledge to solve new problems” (Newmann et al., 2007, p. 4). Producing rather than reproducing knowledge is emphasized and, although the authors recognize this may not be possible at all levels of education particularly the more junior levels, students should always set their sights on authentic expressions of knowledge through guided practice in discourse (Newmann & Archbald, 1992).

The second feature, disciplined inquiry, is described as the process of integrating prior knowledge with an in-depth understanding of the problem at hand to produce knowledge. “For new knowledge to be significant and valid, it must be based on substantive and procedural knowledge that has been accumulated though previous workers in a field who establish facts, vocabularies, concepts, theories, algorithms, and conventions for the conduct and expression of inquiry itself” (Newmann & Archbald, 1992, p. 73). While most schooling appears to stop at the
reproduction of knowledge, Newmann and colleagues contend that learners must move beyond reproduction to develop an in-depth understanding of a problem, which puts prior knowledge to use as learners “assemble and interpret information, formulate ideas and make critiques which cannot be easily retrieved from the existing knowledge base” (p. 73). Finally, disciplined inquiry involves the engagement in elaborated communication where the production of new knowledge is shared with others.

The third criterion described by Newmann and colleagues is that learning has a value beyond evaluation or school. Authentic achievements have utilitarian, aesthetic, or personal value apart from documenting the achievement or competence of the learner. “To summarize”, said Newmann and Archbald (1992):

this vision of authentic achievement requires students to engage in disciplined inquiry to produce knowledge that has value in their lives beyond simply proving their competence in school. Mastery of this sort… is more often expressed in the completion of long-term projects which result in discourse, things, and performances of interest to the students, their peers and the public at large (p. 75).

**A theoretical framework of authentic learning.** While conceptual frameworks are helpful in appreciating the conceptual elements of authentic learning, a theoretical framework integrates theoretical constructs to pose the hypothetical circumstances or principles that explain learning as authentic. A theoretical framework moves beyond a conceptual framework as it makes associations or links between elements to suggest potential theoretically informed relationships. The theoretical framework presented here is that of the Theory of Authentic Learning (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013). The theory offers a theoretical explanation of authentic learning through twelve factors, which arise from the authentic learning environment.

The Theory of Authentic Learning was formed through the study of exemplary technology classrooms thought to reflect environments of authentic learning (Hill & Smith, 1998,
From initial studies, four central factors (situatedness, mediation, embodiment, distribution) and two supporting factors (multiple literacies and motivation) emerged (Hill & Smith, 1998). Later research identified an additional four factors (identity, career planning, human relationships, and teacher attributes) (Hill & Smith, 2005a; 2005b). A most recent study examined students with developmental disabilities as they learned in authentic learning environments. Through this work, two more factors were identified (support network and program) (Hill et al., 2013) as being critical to these learners.

The twelve factors of the Theory of Authentic Learning. To elaborate upon this theory further, its twelve factors will be discussed – both in context of how Hill and Smith defined each factor in their Theory of Authentic Learning and in context of the seminal theory informing such factors.

Situatedness. Situatedness refers to learning in context (Hill & Smith, 2005b). The concept derives from the concept of situated cognition (Brown et al., 1989), which poses that much of what is learned is specific to the situation in which it is learnt. Anderson et al. (1996) summarized four assumptions made of situated cognition. First, action is grounded in the concrete situation in which it occurs. In other words, action cannot be separated or described independently of the specific situation of its occurrence. Second, knowledge does not naturally transfer between tasks. This assumption relates to Thorndike’s theory of identical elements where the transfer of skills and abilities between two different tasks occurs only if the knowledge elements of the tasks are similar (Taatgen, 2013). This means that should a learner develop skills and abilities for one task, they may have difficulty using those skills in context of a different task unless the two tasks share cognitive elements.

A third and related claim of situated cognition is that training by abstraction is of little use for learning. Drawing upon apprenticeship training, Brown et al. (1989) and Collins et al. (1987) argued that targeted skills are instrumental to the accomplishment of meaningful tasks. In
other words, effective learning takes place when the amount of abstract instruction is reduced and concrete illustration and hands-on application is emphasized. Finally, the fourth assumption of situated cognition is that instruction needs to be done in complex, social environments. As Lave and Wenger (1991) argued, “learning is an integral part of generative social practice in the lived-in world” (p. 35). The basis of this assumption aligns with social constructivist theories of learning that view cognitive development as being mediated by the complexities of social interaction.

Overall, situatedness is an important construct in relation to authentic learning as it forms an underlying foundation for informing the understandings of authentic learning as ordinary practices of culture and real communities of practice. If the above assumptions are accepted to be true, then learning occurs when tasks are contextually situated within real life contexts found beyond the confines of the classroom, if not directly (i.e., learners participating in a community of practice), then cognitively (i.e., the task develops cognitive skills that facilitate transfer by nature of their resemblance to the cognitive demands of the targeted context).

**Mediation.** The factor of mediation refers to the cultural and physical tools (i.e., language, computers, classroom supplies, etc.) that influence learning (Hill & Smith, 2003). The concept of mediation is closely associated with Vygotsky’s sociocultural theory of learning and development, which posited that human psychological processes are mediated by semiotic mechanisms and psychological tools such as language, signs, and symbols (Karpov & Haywood, 1998). Examples of what is meant by semiotic mechanisms include language, writing/text, diagrams, aural schemes, maps, etc. as well as other tools recognized in sociocultural discourse – pens, paint brushes, computers, calendars, symbol systems, etc. Burner (1962) summarized the encompassing nature of semiotic mediation when he wrote:

*Man, if you will, is shaped by the tools and instruments that he comes to use, and neither the mind nor the hand alone can amount to much … and if neither hand nor intellect*
alone prevails, the tools and aids that do are the developing streams of internalized language and conceptual thought that sometimes run parallel and sometimes merge, each affecting the other (p. vii)

Mediation, therefore, considers the sociocultural tools, physical and semantic, that influence thought and action. These tools are not invented and used by individuals in isolation, rather they are products of a sociocultural evolution of human engagement with others (John-Steiner & Mahn, 1996).

**Distribution.** For Hill and Smith (2005b), the factor of distribution represents the way in which learning is not confined to one individual mind, but extends outwards to involve other people and tools. As Pea (1993) described, learning and knowledge comes to be distributed “across minds, persons, and the symbolic and physical environments, both natural and artificial” (p. 47). Knowledge and cognition can be both physically and socially distributed (Perkins, 1993). Cognition is physically distributed when tools such as a pen and paper or computer is used to document and store ideas, thoughts, and knowledge. Cognition is socially distributed when two conditions are met: (1) when “the surround – the immediate physical and soci physical environments, both natural and artificial” participate in cognition, not just as a source of input and a receiver of output, but as a vehicle of thought” (Perkins, 1993, p. 90), and (2) when “the residue left by thinking” (Perkins, 1993, p. 90) lingers not only in the mind of the learner but also within the arrangement of the surround. Therefore, learning can be distributed across physical tools such as computers, paper, books, online resources, etc. and it can also be shared or held between people and across communities.

**Embodiment.** Hill and Smith (2005b) described their factor of embodiment as recognizing the central role of the body – its senses and all of its sense-making ability – in learning. Cognitive philosophies of learning tend to divide mind and body – for example, placing priority upon cognitive processes that are seen as detached from the body; the body commonly seen as just
another tool rather than an integral part of learning (Rabusch & Ziemke, 2005). Embodiment, however, understands the body as the medium for sense-making (Bresler, 2004; Macintyre Latta & Buck, 2006); that “we do not have a body, rather we “are” bodily” (Heidegger, 1997, p. 98-99) and in being bodily, we are inextricably linked to the world.

John Dewey generated a concept of embodiment through his philosophy of growth, freedom, and learning. Dewey considered humans as living creatures who live through and within a holistic sense of experience. We are one in the same with our environment and it is only upon reflection, or meta-cognition, that we break up our world into external and internal conditions, that is, our physical body versus the room we are standing in (Dewey, 1958). The Deweyan notion of embodiment “places the human organism fully within the environment – not apart or aloof from it” (Skorburg, 2013, p.69). Learning then involves active engagement both with and through the world.

If we want to understand humans as humans then, says Skorburg (2013), “we cannot limit the scope of our inquiry to the brain, or the nervous system, or the body, or the world. Instead we need an explanatory framework that is capable of taking the continuous, dynamic interactions among these systems” (p. 74). This framework must therefore consider the holistic body and its engagement within and through its holistic environment - the brain, the body, and its senses influenced and influencing the physical and sociocultural environment. With this holistic perspective, connections between embodiment and other factors are inherent – if the body is inseparable from the environment, then it is situated within the context of its surroundings. If we learn both with and through our sociocultural community, then other people and our cultural tools (language, symbols, physical objects, etc.) mediate that interaction. Further, the knowledge developed within and through this intricate web holds and sustains our developed knowledge so that it is not held to one person or object alone but widely distributed. Defining embodiment as a construct in its own right is to consider it, if only briefly, as distinct from its connections to other
factors in an effort to identify the multitude of ways in which the “human organism is as much a part of her environment as her environment is a part of her” (Skorburg, 2013, p. 69).

Multiple Literacies. Authentic learning environments, wrote Hill and Smith (1998, 2005b), both recognize and seek to foster a range of abilities and talents. This factor is closely associated to Gardner’s (1983, 1999) concept of Multiple Intelligences (MI). In the 1980’s Gardner proposed that human beings did not possess a single generalized intelligence but, rather, humans were better described as having a set of relatively autonomous intelligences (Gardner, 2003). He made the case that, “it is fundamentally misleading to think about a single mind, a single intelligence, a single problem-solving capacity” (Gardner, 2003, p. 13) and instead, argued “the mind/brain consists of many modules/organs/intelligences, each of which operates according to its own relative autonomy from the others” (p. 13). In positing this theory, Gardner was challenging historical perspectives of psychology that had treated intelligence as singular, consisting mainly of information processing aspects of linguistic and logical qualities (Gardner & Hatch, 1989; Barrington, 2004). Instead, Gardner proposed that human beings have evolved to carry out at least seven forms of thinking – logical-mathematical, linguistic, musical, spatial, bodily-kinesthetic, interpersonal, and intrapersonal (Gardner, 1983). Continued research into the MI theory through the 1990s supported the existence of new intelligences – naturalist and existential – and by the early 2000’s Gardner recognized that the list would continue to grow with recognition of emotional, spiritual, sexual, and digital intelligences (Gardner, 2003). To be recognized as an intelligence, several criteria had to be met – that the intelligence was an identifiable and separate function of the brain, that it had a biopsychological predisposition, that it was found across cultures and over time, and that is was supported by evolutionary biology and cognitive research (Kezar, 2001). Overall, drawing on Gardner’s MI theory, Hill and Smith referred to Multiple Literacies as a factor of authentic learning to represent and recognize the various ways in which students demonstrate intellectual strengths and abilities.
Motivation. The factor of motivation aims to capture what students want and how they are motivated or driven to learn. The word motivation is based upon the Latin verb *movere*, meaning to move. Motivational theories are concerned, therefore, with what gets individuals moving or energized, and towards what activities or tasks (Pintrich & Schunk, 2003). Various theories of motivation exist, however, *Self-Determination Theory* (Deci & Ryan, 1985; Deci, Koestner, & Ryan, 1999) is regularly referred to within current research on student motivation. In this theory, Deci and Ryan (1985) proposed three basic needs: competence (the desire to be capable and master interactions with one’s environment), autonomy (the desire to be in control of one’s behaviour), and relatedness (a wanting or sense of belonging); all three needs must be fulfilled in order to motivate an individual towards action.

In Pintrich’s (2003) comprehensive review of motivational science perspectives and student motivation in teaching and learning contexts, he identified five families of social-cognitive constructs that have been the focus of research related to student motivation in classroom contexts. These five families are briefly introduced here in an effort to summarize the broad concept of motivation. First, adaptive self-efficacy and perceptions of competency motivate students so that when students expect to do well and believe they are capable of it, they tend to try hard, persist, and perform better. Second, adaptive attributions and beliefs regarding control influence motivation – that is, when students believe they have personal control over their learning they are more like to do well. Third, feelings of interest (personal or situational) and a sense of intrinsic motivation drive students to learn and engage. Fourth, higher levels of perceived value tend to motivate students. Motivation is influenced by whether students care about a task or think it is important. Finally, goals motivate learning such that the content and nature of goals students set for themselves serve to motivate and direct behaviour.

Motivational theory, such as Deci and Ryan’s self-determination theory, and a wide base of literature, such as the work of Pintrich (2003), offer a foundation for understanding the factor
of motivation. Overall, Hill and Smith’s factor of motivation was selected to represent those signs and constructs indicating that students are energized or driven to learn, and what classroom activities or tasks such energies are directed towards.

Identity. Hill and Smith (2005b) wrote “identity is personal growth and the development of identity (who one is) and a sense of self” (p. 27). This factor may be most closely associated with an understanding of the lifeworld, which posits that, just as learning is situated with the context of its acquisition, humans are situated within their lifeworld. The construct of lifeworld originally derived from Husserl’s phenomenological philosophy in which he posited: “we live in the horizon of the lifeworld” (Husserl, 1936/1970, p. 138). “Lifeworld refers to the commonsense interpretive frames and logics by which individuals prereflectively conceptually organize their perceptions of everyday life” (Fincher, 2007). Since Husserl, the concept of lifeworld has been further developed through the works of Heidegger, Merleau-Ponty, Van den Berg, and Boss. A brief introduction to the construct is offered here.

The lifeworld is an experienced world of meaning; it is the world as it appears meaningfully to the consciousness, “a humanly relational world full of meaning” (Todres, Galvin, & Dahlberg, 2007). While Husserl saw the function of the lifeworld as the horizon or backdrop for understanding the world and making meaning of our conscious experiences, Habermas saw the function of the lifeworld as ensuring that interpersonal relations were ordered through shared cultural and linguistic resources (Fairtlough, 1991). Groups and cultures create a shared lifeworld of experiences and assumptions, which moderate individual interactions and communication with others.

Todres et al. (2007) summarized five dimensions of lifeworld, which are helpful in understanding what comprises this construct; these dimensions include temporality, spatiality, intersubjectivity, embodiment, and mood. Temporality refers to time as it is humanly experienced. Todres et al. explained, “Each moment of human experience is part of a story and
temporality gives human experience its storied nature” (p. 56). Spatiality refers to the environment of our world – the places and things that give meaning to our lives. “Things in this environing world do not have simple, unequivocal meanings but have a number of potential meanings depending on where they fit into our lives at that moment” (p. 56). Intersubjectivity refers to the communal nature of our lifeworld – we are in a world with others. “As selves” said Todres et al., “we cannot be understood without reference to how our lives take place within a social world” (p. 56). Embodiment refers to the lived body and how our bodies live in meaningful ways. Our anatomical and physiological body is able to interact and make meaning of our experience without conscious mediation – like knowing where to place our feet without thinking. Additionally, the body has the ability to feel and respond emotionally to the world, for example, when tears well up uncontrollably in response to an emotional event. Finally, and closely linked to embodiment, mood or emotional attunement highlights how our lived experience is mediated by how we feel. “Mood is intimate to how we find ourselves. It is a powerful messenger of the meaning of our situation” (p. 57). For example, the experience of welling up with tears in response to an emotional event would mediate our feelings of the event and the meaning we assign to the experience.

Overall, one’s sense of personal identity is shaped from the perspective of their lifeworld. If we are to understand authentic learning as engaging a learner’s identity, then we must understand learning as mediated by and impacting upon their lifeworld. As educational philosopher and curriculum theorist, Maxine Greene (2009) has argued, learning occurs when students generate understandings on their own initiative, against their own background awareness; their lifeworld. “Meaning emerges in relation to “events” of the lifeworld, and when the lifeworld changes, meaning changes as well” (Dahlberg, 2006, p. 16).

Career planning. For Hill and Smith (1998, 2005a, 2005b), the factor of career planning refers to the ways in which learners relate what they are learning to their future work, or the way
they connect learning to their goals and aspirations for future study, careers, and/or work. This factor aligns with understandings of authentic learning derived from cognitive apprenticeship (Collins et al., 1987; Brown et al., 1989) and the simulation model where learning activities aim to simulate professional practices (Anderson et al., 1996). This factor also closely aligns with Newmann et al.’s (2007) dimension of learning having value beyond school.

This notion of career planning is related to concepts of lifelong career development or planning. Gysbers and Moore (1975) described lifelong career development as “self-development over the life span through the integration of one’s roles, settings and events of a person’s life” (p. 648). Similarly, lifelong career planning is described as a life skill embodying concepts of career awareness, exploration, and skill development (Magnuson & Starr, 2000). Overall, these two notions both suggest that individuals develop a sense of their career over a lifelong endeavor that is influenced by experiences, roles, skills, and understandings.

In offering a theoretical explanation for how career interests and choices develop, Lent and Brown (1996) drew upon Bandura’s social cognitive theory to build a theory of social cognitive career theory (SCCT). This theory was focused on “the processes through which (a) academic and career interests develop, (b) interests, in concert with other variables, promote career-relevant choices, and (c) people attain varying levels of performance and persistence in their educational and career pursuits” (Lent & Brown, 1996, p. 311). SCCT suggests that, through career awareness and exploration, individuals come to favour those activities for which they have an emergent interest, a sense of self-efficacy, and positive outcome expectations. Such interests foster career choice goals, which in turn motivate actions for achievement. The choices we make regarding our goals and behaviour are influenced by a wide variety of contextual influences, such as gender and cultural factors, and a continued sense of self-efficacy.

Hill and Smith’s factor of career planning was intended to capture the ways in which students both shape and are shaped by their notions of lifelong career development/planning. The
factor aligns with Lent and Brown’s SCCT theory for the way in which academic and career interests are thought to inform career-relevant choices and the way in which action upon such choices are mediated by contextual influences.

*Human relationships.* Hill and Smith (2005b) described their factor of human relationships as “the expressions, either positive or negative, about being with others, especially peers” (p. 27). Expressions might include feelings, behaviours, or action that demonstrate a learner’s preferences for and approaches to working with and engaging with others in the classroom. The works of Duck (1994, 1998) illustrate the complex nature of human relationships. “The influence of relationships runs deep through the fabric of social behavior and interpersonal communication. Relationships have real effects on our behaviour and the ways in which we spend our time” (Duck, 1998, p. iii). Duck (1994, 1998) argues that relationships are based upon routines of everyday communication and emotions formed through social and linguistic frameworks for understanding others and expressing ourselves. To be attuned to human relationships in learning is to note the way in which people engage in personal relationships with others and share meaning through communication and emotion.

*Teacher attributes.* An attribute is an inherent characteristic or quality belonging to, in this case, a teacher. For Hill and Smith (1998, 2005a, 2005b), the factor of teacher attributes came to represent those characteristics, qualities, personality and behaviors of the teacher figure in authentic learning environments. Attempts have been made to generalize which characteristics and qualities are typically reflected of great teachers. For example, Orlando (2013) lists nine characteristics of that include qualities such as respectfulness, enthusiasm, a love for learning, and professionalism. Despite such attempts, it is regularly acknowledged that quality teacher attributes are best considered in context of the unique teaching and learning environment. For example, evaluating teacher attributes in urban schools (Sachs, 2004) or attributes of high quality special education teachers (Carlson, Lee, & Schroll, 2004).
Through their investigation of authentic learning contexts, Hill and Smith (1998) described how the teachers in their studied contexts displayed particular attributes – teachers were respectful, showed interest in getting to know their students, often demonstrated that they were continually learning rather than claiming to be an expert, they were highly flexible, and took risks through experimentation. Overall, the factor of teacher attributes represents those qualities of the teacher identified as influential and significant in mediating student learning within the particular context of study.

Support network. The factor of support network emerged from Hill and colleagues most recent work (Hill et al., 2013), which investigated educational experiences of students with developmental disabilities within authentic learning environments. The concept of support network is defined and understood throughout the literature in different ways. The support or social network is broadly understood as the structure of an individual’s social relationships (Pavri & Monda-Amaya, 2001), however, focus is sometimes placed on the number of people within someone’s social support network versus upon the quality/intensity of the social relationships that comprise it (Boekaerts, 1993). A rich network of support for students might include family supports such as parents and relatives, student-to-student supports such as peer-groups and friendships, social/emotional supports, academic supports such as tutoring groups, school-wide supports such programs and clubs, and community-to-school supports such as community volunteers, business partnerships, and neighbours (Boekaerts, 1993; Korinek, Walther-Thomas, McLaughlin, & Williams 1999). While it is recognized that everyone has a support network and that rich support networks are generally beneficial, the concept of support network has gained significant attention in relation to students with learning and developmental disabilities. Students with disabilities tend to have more social difficulties in school and so enhanced support networks are thought to be of particular importance for such students (Korinek et al., 1999; Pavri & Monda-Amaya, 2001; Meadan & Monda-Amaya, 2008).
Program. A second factor to arise from Hill and colleagues’ most recent work is that of program (Hill et al., 2013). This factor considers the curricular elements that influence the learning environment and how it is experienced. Elements of the program include the intended, enacted, and assessed curriculum, and the avenues through which the curriculum is communicated (i.e. curricular documents such as a course syllabus, a rubric, etc.). A brief glimpse into the world of curriculum theory demonstrates the powerful influence curriculum can have over student experience. Bobbitt (2009) advocated that curriculum should “train thought and judgment in connection with actual life-situations” (p. 15). Dewey’s pedagogic creed is said to have “broken down barriers” between children’s life and classroom experiences (Flinders & Thorton, 2009). Freire’s pedagogy of the oppressed aimed to emancipate oppressed classes from capitalist societies by teaching students about and through social justice (Freire, 2009). Taken as examples of the intended curriculum, each of these three examples would result in very different enacted and experienced curricula, as well as differences in how each curriculum was communicated and engaged with by students and teachers alike. Therefore, the factor of program represents the identified elements of the curriculum and their influence upon students and teachers.

Links between factors of the Theory of Authentic Learning. Now that each factor has been defined, explained, and explored in context of the supporting literature, this section will explore the linkages between factors as deduced from Hill and Smith’s initial studies (1998, 2003, 2005a, 2005b).

Figure 2.7 depicts the linkages found between factors. Factors were found to be connected in three different ways: (1) they could be associated with one another in a symmetric connection \((=\)=), (2) one factor could be a part of another in a transitive connection \(([\ ]\)) , or (3) one factor could be the property of another factor in an asymmetric connection \((*\)=). A full report of Hill and Smith’s findings can be found in Hill and Smith (2003, 2005b), however, a few linkages of note are briefly explored here, if only to highlight the complex nature of authentic learning.

*Links between situatedness, embodiment, mediation, and distribution.* First, the factors of situatedness, embodiment, mediation, and distribution are closely interlinked. Mediation is a part of situatedness - when learning is situated within a culturally or professionally relevant context it involves the use of specific tools unique to that context. For example, learning to become a baker in a situated context would involve the use of measuring cups, ovens, pans, recipes, etc.
Mediation is also a part of distribution - when learning and knowledge is shared between peers, they do so through the use of tools and language that influences their engagement. For example, using email to communicate with others.

Embodiment is a part of situatedness. In other words, when learning is situated it is embodied. Returning to the baker example, learning to bake in a situated context means learning through the body – feeling when the dough is of the right consistency, smelling the baking bread, etc. Further, embodiment is a property of mediation. The use of various tools within an authentic learning context invariably involves learning through the body and its sense-making abilities.

Situatedness is a property of distribution. Learning in relation to some culturally or professionally relevant context involves connecting, sharing, and engaging with others, such as professionals or members of the community. For example, learning to bake by engaging with and learning from a professional baker.

The central role of identity. Identity lies at the centre of the figure with seven different linkages to other factors. It is associated with distribution, human relationships, teacher attributes, career planning, motivation, and multiple literacies. Further, embodiment is a part of identity. These linkages highlight the numerous ways in which a learner’s identity – sense of self and lifeworld – affect and are affected by the way they relate to and work with others, how they engage their strengths, how they foresee and plan for their future, and how they are driven or moved to learn.

Overall, the linkages between factors highlighted here, as resembled in Hill and Smith’s Theory of Authentic Learning (2003, 2005b), illustrate the complex nature of authentic learning.

The Theoretical Framework of This Study

The theoretical framework utilized for this study draws upon Hill and Smith’s Theory of Authentic Learning, and its twelve factors as defined and elaborated upon in the above section. To briefly reiterate, authentic learning is defined as a learning environment where the cognitive,
physical, and interpersonal demands of learning are congruent with those of real life (Hill & Smith, 2005a; Savery & Duffy, 1995). While there are three different orientations toward authentic learning (authentic activities as ordinary practices of culture, authentic learning as participation on real communities of practice, and authentic learning as engaging in students’ lived experiences), authentic learning is arguably achieved only when elements of all three orientations come together - when learning is situated in the specific professional or academic culture; when it brings together students, peers, teachers, and experts as a community that shares and develops knowledge together; and when students are able to not only see themselves reflected in their learning but are challenged to draw upon their unique ways of knowing, and the uniqueness of their peers to share in a process of meaning-making. While conceptual frameworks posed by Herrington and colleagues (Herrington, 2006; Herrington & Herrington, 2005; Herrington & Oliver, 2000) and Newmann et al. (2007) attempt to capture the complex nature of this environment, it is Hill and Smith’s Theory of Authentic Learning that draws a more complete picture of the factors involved and their interactions with one another.

It is from this perspective that this study finds its theoretical basis. Inquiry learning in the context of anatomy education is explored through this theoretical lens in order to address the research questions posed. Up to this point, the literature relating to inquiry and authentic learning has been discussed. However, there remains one final component requiring exploration, and that is a consideration of the context of anatomy education – its historical context, what is known of students’ learning, and the contemporary pedagogies utilized in teaching and learning.

Anatomy Education

The discipline of anatomy focuses on the normal form and function of the human body. Traditionally considered important in medical study and practice, anatomy is now a common subject of study for students in all health-related fields such as medicine, dentistry, nursing,
physiotherapy, and occupational therapy, as well as students of human kinetics and engineering fields such as biomechanical and pharmaceutical engineering.

A historical context. Reviewing the development of the discipline over time provides a historical context important in understanding how anatomy is taught and learnt today. The origins of a Western discipline of anatomy can be traced back to the early 16th century when arist-anatomists such as Leonardo da Vinci (1452 –1519) and Andreas Vesalius (1514 – 1564) depicted the anatomical body through art. For example, da Vinci produced more than 240 artistic sketches of human anatomy based upon more than 30 cadaveric dissections he performed (Sooke, 2013). In 1543, Vesalius published the first illustrative atlas of anatomy based solely on human dissection, titled *De humani corporis fabrica* (On the Fabric of the Human Body). The atlas includes six volumes of anatomical diagrams, many of which depict the body in an artful and expressive position. Through their work, Vesalius and da Vinci both laid “the groundwork for a tradition of anatomical learning based exclusively on the dissection of human cadavers” (Ponce, 2012, p. 10). In addition to placing an emphasis on cadaveric dissection, these early anatomists also brought attention to the humanistic qualities of anatomical study through their artistic expression of the lived body.

After da Vinci and Vesalius’ time, the discipline of anatomy continued to develop, mainly in tandem with medical education. Dissection became an opportunity for hands-on training (Hildebrant, 2010; Loeb, 1911), and served as a professional rite of passage, introducing students to both cognitive and affective components critical of professional character (Warner & Rizzolo, 2006). Dissection served not only as training in the manual dexterity, scientific reasoning, and problem-solving aspects of medicine (Bender, 2002; Gregory & Cole, 2002; Warner & Rizzolo, 2006), but also served as a ritualistic initiation into important lessons of life and death (Bender, 2002; Coulehan, Williams, Landis, & Naser, 1995; Warner & Rizzolo, 2006), and the “cultivation of an affectionate sympathizing spirit” towards one’s patient (Morril, 1840,
as quoted in Warner & Rizzolo, 2006 p. 404). Throughout this time, “the affective, subjective, and emotional aspects of human dissection were seen as part and parcel of teaching and learning of medicine” (Warner & Rizzolo, 2006, p. 407).

The discipline transitioned towards a more positivistic and scientific philosophy in the 19th century, when the formation of governing bodies, such as the American Medical Association in 1847 and the Medical Council of Canada in 1912, in combination with the highly influential Flexner Report of 1910, led to the accreditation and regulation of medical schools across North America (Beck, 2004; Cooke, Irby, Sullivan, & Lundmerer, 2006). These governing bodies deemed the apprenticeship approaches and unregulated proprietary schools of the time as “highly variable and frequently inadequate” (Beck, 2004, p. 2139) and criticized them for being a non-scientific approach to medical study (Cooke et al., 2006). As a result, significant changes led to the reform and standardization of medical education across North America. Numerous changes resulted. First, university-based accredited medical schools replaced unregulated proprietary schools and apprenticeship training (Hildebrant, 2010; Louw, Eizenburg, & Carmichael, 2009). Second, anatomy was adopted alongside other disciplines to form a standardized curriculum for the early years of medical study. A “fundamental design plan” was adopted “in which two years of mainly basic sciences are followed by two years of clinical rotations” (Klement, Paulsen, & Wineski, 2011, p. 157). This placed studies of basic sciences, including gross anatomy, embryology, physiology etc., ahead of the practical application of clinical rotations. To suit this model, the discipline of anatomy was to focus on the acquisition of a sound knowledge of the human structure (Warner & Rizzolo, 2004), which would be later applied and recalled in clinical practice. The modern medical curriculum was shaped upon a foundation of European-borne scientism, rationalism, and discipline-based preparation for a disease-focused world (McLachlan & Patten, 2006; Papa & Harasym, 1999). As Warner and Rizzolo (2006) explained, in light of
this shifting philosophy “[anatomists] jettisoned attention to the emotional aspects of dissection” (p. 407), and replaced it instead with a strong emphasis upon the facts of the human body.

Dissection was retained as the laboratory component of anatomical study and didactic lectures that prepared students for their laboratory work became the gold standard (Older, 2004; Turney, 2007). The traditional curricula based on anatomical systems came to fruition as lectures were planned to align with the dissection schedule, which was limited to the way one might approach full body dissection (Louw et al., 2009). Nearly a century later, Sugand, Abrahams, and Khurana (2010) would list didactic lectures as the most prevalent pedagogy in anatomy – an indication of the practice’s pervasiveness and longstanding influence on anatomical education.

During the second half of the 20th century, medicine underwent large shifts including a rapid and large-scale expansion of medical science knowledge, rapidly changing medical practice, and the emergence of new and complex health problems such as AIDS, SARS, diabetes, and dementia (Leung, Lue, Lu, & Huang, 2006). In light of these changes, anatomy has been referred to as a discipline in crisis (Collins, 2008) – course hours dedicated to its study have been drastically reduced (Leung et al., 2006), dissection practices have been eliminated from the many curricula (Gillingwater, 2008; Korf et al., 2008; McLachlan, Bligh, Bradley, & Searle, 2004; Jones, 1997), and there are increasing claims that students show inadequate knowledge and an inability to apply anatomy to their clinical practice beyond their basic science coursework (Waterston & Stewart, 2005).

One approach to combat this crisis has been to offer anatomy courses at the pre-professional undergraduate level before students enter into their medical and health professional studies. As Darda (2010) explains:

the benefit to such students is the promise of being better prepared for the preclinical, basic science component of professional healthcare programs. The reasoning is simple. We tell our students that they will be faced with tremendous course loads as a beginning
student in professional healthcare programs. The more knowledge and understanding of anatomy they take into their program with them, the better equipped they will be to survive the onslaught. (p. 75)

However, the curricula at this level tend to mimic curricula at the professional level and face the same challenges and critiques outlined above.

Smith and Mathias (2007) summed up current perspectives on anatomy resulting from this long history when they wrote:

anatomy is often perceived as the introduction to “real” medicine and an important component in the initial process of socialization into professional practice. However, it is also perceived as involving the learning of a challenging range of knowledge, concepts, skills, and attitudes as part of a professional rite of passage […] Arguably, the context of learning is one which could easily push students towards adopting a surface approach. (p. 847)

This brief history of anatomy education reveals a shift away from the affective elements of the human form towards a positivistic and scientific philosophy that emphasizes basic science knowledge over practical application. The next section explores investigations into how students typically approach their learning of anatomy.

**Student learning in anatomy.** The belief that students take surface approaches, such as the rote memorization of disconnected facts, to their study of anatomy is common throughout the literature (Miller, Perrotti, Silverthorn, Dalley, & Rarey, 2002; Pandey & Zimitat, 2007; Ward, 2011). As Arthur Dalley wrote:

As a teacher of anatomy for practitioners of the health sciences, it is my impression that most students who complete their undergraduate experience that includes a course in anatomy and physiology believe that anatomy is primarily about the recognition and naming of structures, often on bare skeletons, or on isolated bones or organs.
(terminology). Anatomy is typically recalled by former students as involving rote memorization of endless lists and tables of terms. (Miller et al., 2002, p. 75)

Due to this assumption, much of the research on how students learn anatomy has focused on surface and deep approaches to learning, which draws upon the landmark works of Marton and Säljö (1976a, 1967b). Pandey and Zimitat (2007) found that nearly half of their research participants adopted memorization strategies as a key aspect of their learning, however, they also found that students most commonly combined their surface approaches with deeper approaches such as understanding and visualization. Smith and Mathias (2010) detailed that students taking a surface approach to learning felt that the amount to learn was daunting, that they failed to see the point of learning anatomy, and took an approach of “just memorize it”. On the other hand, students taking a deep approach to learning anatomy took exploratory and holistic approaches that were not driven by facts but by a goal to understand and apply knowledge. Smith and Mathias specified that their students tended to engage deep approaches to learning when they understood anatomy in context of radiology.

**Contemporary pedagogies in anatomy.** Based upon findings from studies such as those conducted by Pandey and Zimitat (2007) and Smith and Mathias (2007, 2010), anatomists are increasingly recognizing that deep approaches to learning are valuable. As Smith and Brennan (2013) wrote, “a key element to success in understanding anatomy is to take a deep approach, place the learning in context and to learn in a way that is active” (p. 96). Pedagogies such as problem-based learning (Cowin et al., 2010; Langlois et al., 2009), case-based learning (McBride & Prayson, 2008; Parmar & Rathinam, 2011), inquiry-based learning (Brown, 2010; Chaplin, 2003; Lee, Anstey, & MacKenzie, 2012), and team-based learning (Hoon Kang, Shin, & Hang, 2011) have been commonly utilized to target deeper forms of learning and understanding. Overall, these pedagogies aim to extend learning beyond the content itself by providing a wider
context for knowledge application. Given the focus this literature review has had upon IBL, a review of IBL within anatomy education is warranted and is examined next.

**IBL in anatomy.** Literature on the use of IBL in undergraduate anatomy education is limited; however, where IBL has been described, it has been utilized in a variety of ways. Brown (2010) described a process-oriented guided-inquiry (POGIL) approach that was used to replace 50% of anatomy lectures in a general undergraduate anatomy and physiology course. POGIL activities were short (65-minute long) guided activities that required students to work collaboratively in small groups of 3 to 4. Each POGIL activity had students explore anatomical concepts through a series of critical thinking questions. In addition to describing the approach taken, Brown conducted an analysis of student grades to compare performance on POGIL vs. non-POGIL components of the course. Brown concluded that student performance on examinations was significantly improved for content learnt through the POGIL sections as compared to the content learnt through the lecture-only format.

Chaplin (2003) described a laboratory design consisting of units where one week of anatomical dissection was followed by two weeks committed to a student-originated project, culminating in a written scientific report or an oral presentation of the topic to the class. In addition to describing the approach taken, Chaplin presented results from a survey evaluation of student learning gains. Self-reports demonstrated high levels of student satisfaction with the approach and an increased interest in the discipline. Further, students reported feeling more comfortable with their abilities as a scientist and their abilities to conduct scientific work. Taking a similar approach, Meuler (2008) described a guided inquiry approach in a vertebrate anatomy lab. Dissection was combined with a research paper assignment. Benefits of this approach were anecdotally noted, and included the development of critical thinking skills and providing students with an increased opportunity to review relevant content.
Lee et al. (2012) characterized an inquiry project for second-year pre-professional undergraduate students based upon assessment surveys conducted with students. Student responses suggested the project was useful in the development of teamwork skills, achieving personal goals for learning, and fostering deep learning of anatomy. Authors concluded that “These observations offer a favourable view of IBL as presented here and support the integration of active-learning methods in large-scale, undergraduate anatomy courses to augment the student learning and to expose perspective instructors to active-learning strategies at the pre-professional level” (Lee et al., 2012, p. 1).

Finally, IBL served as an inspiration in the development of a highly creative method of teaching anatomy as described by Hermiz et al. (2011). In this approach, students implemented a protocol for making postmortem anatomical casts of the bronchial tree and coronary arteries. This process was facilitated by an instructor who guided students’ learning through the asking of open-ended questions to guide students toward the development of their own conclusions. In their article, Hermiz et al. focused on describing the learning activity itself rather than evaluate the achievement of specific learning outcomes. However, the authors do conclude that the project created a desire to learn and helped students to better appreciate the anatomical concepts explored.

Considered together, the above studies demonstrate that students taking an IBL approach perform better on examinations; show increased interest in, desire for, and satisfaction in learning; demonstrate improved critical thinking; and take deeper approaches to learning.

**Authentic learning in anatomy.** Despite initial success with deep approaches to learning anatomy (such as IBL), anatomists such as Dalley (Miller et al., 2002) believe that very anatomists are “doing a very good job of making the true purpose of anatomy sufficiently evident” (p. 75) to students. Deep and surface approaches to learning aside, there is continued need for teaching and learning practices that reflect the true nature of the discipline itself. For
example, in a phenomenographic investigation of medical students’ experiences of learning anatomy within a traditional medical curriculum, Wilhelmsson et al. (2010) found that:

failing to construct a meaning for oneself or experiencing a missing link between phenomena in the teaching, both resulted in an experience of disconnection. The experience of meaning – predominately sought after by the subjects in the study – disappeared and the students were forced into a corner of rote-learning, one of its main features being a deficit in meaningful context. (p. 163)

As a result of his work, Wilhelmsson et al. concluded “there seems to be a need for contextualizing anatomy in order to make it meaningful” (p. 163). Based on this evidence, it is apparent that what the discipline of anatomy requires is a way to orient learning of the discipline in context of the discipline itself, as well as students own lives.

Summary

This chapter has focused on a literature review of the three central areas related to this study: (1) inquiry-based learning, (2) authentic learning, and (3) anatomy education. I examined various perspectives of inquiry-based learning and authentic learning through exploration of various models, conceptual frameworks, and theoretical frameworks of the two respective areas.

In consideration of these perspectives, I described the theoretical framework used for this study – a framework based mainly upon Hill and colleagues’ Theory of Authentic Learning (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013). In the final section of this literature review, I focused upon the literature available on anatomy education, providing a historical context and review of contemporary issues in teaching and learning within the discipline.

In the following chapter, I provide an overview of the methodology and methods utilized in the process of data collection and analysis in this study. I describe a hermeneutic phenomenological methodology and a qualitative case study design, and then describe the steps
taken for recruiting participants, collecting and analyzing data. Ethical considerations are also elaborated upon.
Chapter 3

Methodology and Methods

This chapter presents the overall methodology and specific methods used to collect and analyze data in order to address the study’s research questions. This chapter begins with a discussion of a qualitative hermeneutic phenomenological and case study methodology. Next, a detailed description of the research methods is provided. This includes: participant recruitment and selection; the research design consisting of observation, interviews, video recording, and artifact collection; and data analysis procedures. Finally, the qualitative research validity and ethical considerations are considered.

A Hermeneutic Phenomenology Methodology

A qualitative hermeneutic phenomenology methodology using a case study design was employed in order to investigate students’ lived experiences of an inquiry-based learning project for human gross anatomy. Creswell (2013) defines qualitative research as:

an inquiry process of understanding based on a distinct methodological approach to inquiry that explores a social or human problem. The researcher builds a complex, holistic picture; analyzes words; reports detailed views of participants and conducts the study in a natural setting. (p. 300)

A qualitative approach is context-sensitive and involves direct collection of rich, in-depth data focused upon participants’ understanding, descriptions, labels, and meanings (McMillian & Schumacher, 2010).

Hermeneutic phenomenology is a form of qualitative understanding and investigation (van Manen, 1990). Phenomenology in general, involves the study of complex human experiences as they are actually lived. It aims to describe common meanings from several individual’s lived experiences of a phenomenon, such as learning (Creswell, 2013). Hermeneutics
adds an interpretive element upon phenomenology (Ajjawi & Higgs, 2007). It is through language that humans are able to express the facts of their lived experiences, and so the hermeneutic exploration of a phenomenon arises from an interpretive process of the textual representations of experience (van Manen, 1990). Taylor (1971) proposed hermeneutics as a form of interpretation that makes explicit the meaning expressed by or for subjects. Moustakas (1994) elaborated upon this when he stated that hermeneutic science “involves the art of reading a text so that the intention and meaning behind appearances are fully understood” (p. 3). Therefore, as a theory and practice of interpretation, hermeneutics offers a way of looking at texts (aural, written, and forms of multimedia) in order to elicit the meaning of the lived experience as communicated through media. Overall, hermeneutic phenomenology searches for the essence of what it means to be human and seeks a description of experiential meanings as they are lived (van Manen, 1990).

**Why hermeneutic phenomenology?** A hermeneutic phenomenology methodology was selected due to the way in which the methodology aligned with the research questions posed and informed the method to research. Hermeneutics – with its focus on the linguistic expressions of meaning – and phenomenology – with its focus on the study of essence and meaning (Merleau-Ponty, 1968) – are the two most appropriate approaches for exploring the research questions posed. The first main research question aimed to understand what the learning experiences are like for students. As van Manen (1990) states, “Phenomenology does not ask, “How do these [learners] learn this particular material?” but asks, “What is the nature or essence or experience of learning (so that I can now better understand what this particular learning experience is like for these [learners])?”” (p. 10). Using hermeneutic phenomenology allowed for students’ experiences of inquiry learning to be teased out through the exploration of lived experiences, of students’ everyday experiences of learning anatomy through inquiry. Phenomenological theorist Heidegger (1962), emphasized that words help us understand and express essence and meaning. As Dahlberg (2006) summarizes the writing of Merleau-Ponty: “Language cannot be separated from
thought (or meaning), and language is not merely the expression of an already formed thought (or meaning), i.e. it is not only language that is altered in relation to thought (or meaning). Rather, thought as well as meanings can be discovered, and understood differently, through [participants] expression in language” (p. 17). Therefore, methods focusing on the recordation of language – whether in interview discussions, observational notes, conversations between students, etc. – offer a valid way to get at the essence of meaning and experience.

I do not stop, however, at simply recording or reporting on the text as collected. Smith (1999) argued a requirement for hermeneutical explorations is a deepening sense of the basic interpretability of life itself, encouraging researchers to “take up the interpretive task for oneself rather than simply receiving the delivered goods as bearing the final word” (p. 39). Hermeneutic inquiry is inherently creative; it is “about creating meaning, not simply reporting on it” (Smith, 1999, p. 42). Whereas ethnographic and grounded theory approaches work to account for people’s thoughts and actions from their own point of view, hermeneutics accepts the impossibility of separating the researcher from the text. The purpose then “is not to translate my subjectivity out of the picture but to take it up with a new sense of responsibility – to make proposals about the world we share with the aim of deepening our collective understanding of it” (Smith, 1999, p. 42). It is through this lens of interpretation that the second research question was addressed. The goal being to “meaningfully deconstruct what is going on and propose alternative, more creative ways of thinking and acting” (Smith, 1999, p. 40) about inquiry learning and the student experience.

A Case Study Design

In addition to a qualitative hermeneutic phenomenological methodology, a case study design was utilized. The research was situated within a single context and a single case, with three embedded units of analysis (Figure 3.1).
The context was a second-year undergraduate course in human gross anatomy at a Canadian university in the province of Ontario. The case of study was an inquiry-based project (referred to as ‘Inquiry Project’) that was one component of the human gross anatomy course. For the project, students enrolled in the course were divided into groups of six students and each group was mentored by a student facilitator (a senior undergraduate student who has previously completed the course). The three units of analysis in this study were three student groups engaged in the Inquiry Project and their facilitators. The context, case, and units of analysis are detailed next.

**Context:** a second-year undergraduate course. The context of study was a second year undergraduate course offered through a Department of Sciences at a Canadian university in Eastern Canada. It is a required course for undergraduates in a life/health sciences program and an elective for students in other programs such as biology, kinesiology, and pharmacology and toxicology.

Approximately 200 students enroll in the course each winter term. The course expands upon its sister course, which is offered in the fall term, and explores the principles of human structure and function by observing the microscopic and gross anatomy of the cardiovascular, respiratory, lymphatic, endocrine, digestive, and genitourinary systems. The course consists of
three components: lectures, laboratories, and the Inquiry Project. Students attend three 50-minute lecture sessions per week given by the course director or invited lecturers, where the bulk of course content is covered. Students are assessed on content discussed in lecture through three block tests scheduled throughout the term. These tests use multiple-choice style questions to assess three levels of student understanding: (1) the ideas learned, (2) making connections between ideas, and (3) the extensions made from ideas (Fostaty Young, 2005). In addition to their lectures, students participate in a weekly 2-hour laboratory session that is guided by graduate teaching assistants (TAs) in the university’s anatomy museum and laboratory. To assess content covered in the laboratories, students complete two bell-ringer laboratory examinations where they are required to identify gross and morphological structures as well as incorporate other ideas, such as the functions of structures and the spatial relationships between them. The third component of the course is the Inquiry Project, where students work in groups of six and use an inquiry-based learning approach to answer an anatomical question of their choosing. This project is the “case” in this research.

This site was selected because the course included an inquiry-based learning curriculum. Entry to the site was gained through communication with the course director who permitted the research study to be completed within the context of the Inquiry Project.

**Case: the inquiry project.** The Inquiry Project is a group- and inquiry-based learning activity that has been a part of the human gross anatomy course since 2009. The Inquiry Project commences within the first few weeks of the academic term and runs for the length of the term (approximately nine weeks). At the beginning of the term, students are randomly organized into groups of six by the course’s support staff. In total, approximately thirty groups of six students are formed. At this point, student groups are also assigned a facilitator. The facilitator role is typically filled by senior undergraduate students who have recently completed the course
themselves and have returned to serve in a volunteer role as a facilitator for the Inquiry Project portion of the course. Each facilitator is assigned 3 to 4 student groups.

The course director introduces students to the Inquiry Project during a lecture time by outlining the project and initial instructions. Students are told that they are to generate an anatomical based question of their interest and launch into their inquiries within small groups. At this point it is emphasized that more important than the anatomical knowledge gained, is the process established and followed to gain this knowledge and the sharing of this process with peers. Also at this point, students are informed of their group assignments and are told that their facilitator will be in contact to arrange a facilitated meeting. As students progress through the project, they meet with their facilitator for a total of four required facilitated meetings. During these meetings, facilitators track the group’s process, provide support and guidance on the project, and stimulate students’ thinking through the use of critical questioning techniques.

The Inquiry Project culminates in a 15-minute presentation on the Inquiry Question and findings. Each facilitator is responsible for organizing and conducting the presentation session for his or her groups. Each group, therefore, presents to the 2 to 3 other student groups who are under the facilitator’s guidance. The Inquiry Project is worth 15% of the students’ overall course grade. This 15% is broken down into four components: personal goals, a peer evaluation, a group process, and a final presentation component. For the personal goal component, students set one personal goal related to the project at the outset of the project (for example, improving time management, developing presentation skills). Students take action to achieve their goal and produce measurable evidence of their progress. Throughout the term, students compose three reflections (1 to 2 pages in length) on their goal and progress. This reflection is submitted to the facilitator for evaluation and marked based upon a rubric provided by the course director. Students are evaluated on their ability to articulate their goal and demonstrate measurable progress over the term. For the peer evaluation measure, each group develops their own peer
evaluation rubric at the outset of the project, which is used to evaluate one another at the end of term. Peer evaluation rubrics often include measures of attendance, teamwork, and contribution. Thirdly, the group process mark is derived from facilitators’ observations of the group’s four facilitated meetings. The facilitator evaluates the group on aspects such as initiative, teamwork, and conflict resolution. Finally, students’ final presentations are evaluated by the facilitator for effective and creative communication of the Inquiry Question.

**Embedded units of analysis: inquiry groups.** As highlighted above, students are organized into groups of six and assigned a facilitator. In total, approximately 30 groups are formed. For this study, three of these inquiry groups served as the units of analysis. Each of these units consisted of six undergraduate students and one senior undergraduate facilitator.

**Participant Recruitment and Selection**

There were two types of participants in this study: students and facilitators. Selection and participation of each followed different procedures, which are described in this section.

**Student participant recruitment.** On the first day of the academic winter term, the course director introduced students to the Inquiry Project. At the end of this session, I was invited by the director to give a brief 5-minute presentation to the class inviting students to participate in this study. Students were provided with a Research Package (Appendix A), containing one copy of the Student Letter of Information, Student Consent Form, and Video Consent Form. After the research was verbally explained, students were given time to read the Letter of Information, complete the consent form, and ask questions. Students were then asked to leave their packages in buckets located at the exits of the lecture hall.

**Selection of student participants.** Of the approximately 150 students invited, 22 students left their package with a complete consent form in the bucket as they exited the lecture session. This indicated that those 22 students were interested in participating in the research. In order to create three units of analysis, a maximum of 18 students (six students per group) could be
included in the study. Due to this limitation, the Letter of Information specified that “not all those agreeing to participate in the study will be included in the study” and that, “those students selected for inclusion in the study will be informed of their inclusion via email”. Three students failed to complete the consent form in full as they failed to check ‘Yes’ to the question “Do you wish to participate?” and one student specified that they did not consent to being videotaped. Therefore, these four students were omitted from the research. The remaining 18 students were included in the study.

Units of analysis for the study were limited to six students per group as this was the pre-established structure followed by the Inquiry Project. Each year, a staff member in the Department assists the course director in randomly grouping students from the course into their inquiry groups. To maintain this pattern, a list of the 18 selected student participants was provided to the staff member. She then formed three inquiry groups from this list of 18 using a similar randomized approach taken for non-participating students of the course. In order to protect the identity of the consenting student participants, the staff member signed a Confidentiality Form (Appendix B)

Once the staff member had organized the 18 student participants into their inquiry groups, two students from each of the three groups were randomly selected for the interview component of the research study. To do this, group members were listed in an Excel spreadsheet with each name occupying a single numbered cell. A random number generator was then used to randomly select a number from the corresponding cells. The student listed in this cell was then contacted via email correspondence (Appendix C) and their consent was gained for participating in a series of interviews across the term. Of the six students initially selected for interview, all six consented to participation. Interviews were scheduled via email correspondence and were held in private rooms across campus.
Once interview participants were confirmed, the remaining 12 student participants were also contacted via email (Appendix C) to confirm their participation in the study. A scanned copy of the student’s completed Research Package was attached to each of the confirmation emails sent.

**Gender proportions of selected student participants.** In 2013, there were a total of 164 students enrolled in the anatomy course. Ninety-seven (60.2%) of these students were female while sixty-seven (40.8%) were male. Of the 18 student participants selected for inclusion in this study, 12 (66%) were female and 6 (33%) were male. In comparison to the population of the class, student participants were representative of a similar gender balance between female and male. While these proportions are important to note here, the impact of gender upon students’ experiences of learning was not a specific focus of this particular research study. It would, however, make for an interesting examination in future studies.

**Facilitator participant recruitment.** Facilitators are typically third- and fourth-year undergraduate students who completed the anatomy course and the Inquiry Project in their second year. Each year, before the anatomy course commences, interested students contact the course director and express their interest in volunteering as an Inquiry Project facilitator. The course director then arranges a meeting with facilitators early in the winter term to orient them on their role. In addition to the support and direction provided by the course director, a lead facilitator works to coordinate and lead the facilitators throughout the term. In the year of data collection for this study (2013), the lead facilitator was someone who had served as a facilitator in the past and therefore had intimate knowledge of the project.

In 2013, eight facilitators volunteered for the role. To invite these facilitators to the research study, I attended their introductory meeting with the course director where I explained the study and invited each of them to participate. Facilitators were provided with a Research Package (Appendix D), containing one copy of the Facilitator Letter of Information and
Facilitator Consent Form. After the study was verbally explained, facilitators were given time to read the Letter of Information, complete the Consent Form, and ask questions. Facilitators were then asked to return their packages to me in sealed envelopes provided. Additionally, the lead facilitator was invited to participate in the study and was provided with the Research Package.

**Selection of facilitator participants.** Of the eight facilitators and one lead facilitator invited, four facilitators and the lead facilitator submitted a consent form indicating their interest in participating. In order to create three units of analysis, a maximum of 3 facilitators (one facilitator per unit) could be included in the study. Due to this limitation, the Letter of Information specified that, “not all those agreeing to participate in the study will be included in the study. All facilitators voluntarily willing and interested in participating in the study will be subjected to selection criteria for determining inclusion in the study. Inclusion criteria will be based upon the organization of Inquiry groups. A staff member from the Department of Anatomy will be consulted in the process. Those facilitators selected for inclusion in the study will be informed of their inclusion via email.”

The staff member from the department tasked with forming inquiry groups was provided with a list of the four facilitators who consented. The staff member then randomly paired consenting facilitator participants with one of the three groups formed from consenting student participants. Through this process, three of the consenting facilitators were each assigned one of the student groups, while one consenting facilitator was not assigned a research study group and therefore was not included in the study. All four facilitators and the lead facilitator were contacted via email to confirm their participation or exclusion from the study (Appendix C). At this point, the participants were provided with an electronic copy of their completed Research Package.

**Summary of selected participants and pseudonyms.** To summarize, a total of 18 student participants, three facilitator participants, and one lead facilitator participant were selected for inclusion in the study. Three groups of six students were organized to form inquiry groups and
each group was assigned a facilitator. Six of the 18 student participants, two from each of the three inquiry groups, were randomly selected for the interview component of the study. Interview participants were invited to select their own pseudonyms at the beginning of their first interview. Non-interview participants were assigned a pseudonym. The pseudonyms selected or assigned to each participant are summarized in Table 3.1.

Table 3.1.

**Participant Pseudonyms**

<table>
<thead>
<tr>
<th>Group</th>
<th>Participant</th>
<th>Pseudonym</th>
<th>Gender Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Lead facilitator participant</td>
<td>Claire</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student interview participant</td>
<td>Lyn</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student interview participant</td>
<td>Sue</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>A.S.1.</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>A.S.2.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>A.S.3.</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>A.S.4.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Facilitator participant</td>
<td>FA</td>
<td>Female</td>
</tr>
<tr>
<td>B</td>
<td>Student interview participant</td>
<td>Heather</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student interview participant</td>
<td>Sam</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>B.S.1.</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>B.S.2.</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>B.S.3.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>B.S.4.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Facilitator participant</td>
<td>FB</td>
<td>Male</td>
</tr>
<tr>
<td>C</td>
<td>Student interview participant</td>
<td>Caleb</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student interview participant</td>
<td>Jane</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>C.S.1.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>C.S.2.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>C.S.3.</td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Student participant</td>
<td>C.S.4.</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Facilitator participant</td>
<td>FC</td>
<td>Female</td>
</tr>
</tbody>
</table>

Each inquiry group was given a letter-based pseudonym of A, B, or C. Student interview participants were invited to select their own pseudonym and were referred to by this name. All other student participants (those student participants not interviewed) were assigned a standardized pseudonym based on their group assignment. This pseudonym was represented as groupletter.S.number where group letter was A, B, or C, the S represented student, and the number represented their assignment as one of the four remaining students in the group aside
from the two student interview participants. The lead facilitator was given the pseudonym ‘Claire’. Facilitator participants’ pseudonyms were associated with the student groups and were referred to by this group reference.

Data Collection

Table 3.2 summarizes the methods of data collection utilized, the type of data collected from each method, and the overall timeline of its collection across the Inquiry Project. Methods used included observations, interviews, video recordings, and artifact collection.

Table 3.2.

Summary of Data Collection Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Purpose</th>
<th>Participants</th>
<th>Data</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Access the phenomenon of learning in context, observe interactions between participants and other influencing factors</td>
<td>All student and facilitator participants</td>
<td>Field Notes (observations and observer comments)</td>
<td>Facilitated and unfacilitated work times observed across the term</td>
</tr>
<tr>
<td>Interview</td>
<td>Exploring and gathering experiential narrative material, serving as a vehicle to converse with participants about the meaning of their experiences</td>
<td>Student interview participants, facilitator participants, and lead facilitator participant</td>
<td>Transcribed audio recordings</td>
<td>Three interviews with student participants: before Inquiry Project commenced, halfway through the term and upon the project’s completion. One interview conducted with facilitators and lead facilitator at Project completion. Groups’ final presentations</td>
</tr>
<tr>
<td>Video Recording</td>
<td>Capturing a potentially data-rich event as students presented a culmination of their work and expressed their learning in a variety of ways</td>
<td>All student participants</td>
<td>Video files</td>
<td></td>
</tr>
<tr>
<td>Artifact Collection</td>
<td>Collection of textual information regarding course structure, project development, and students’ experiences</td>
<td>All student participants</td>
<td>Curriculum Documents, Facebook and Google Docs artifacts, personal goal reflections</td>
<td>Collected across the term</td>
</tr>
</tbody>
</table>

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**Observations.** Observations were conducted with each of the three groups and occurred at various points across the term during formal facilitated meetings (students + facilitator), formal in-class work periods (students only), during informal unfacilitated meetings (students only), and during final presentations. Table 3.3 outlines the observation schedule followed. All observations were conducted by myself and were held in various rooms across campus depending on the arrangements made by the participants themselves.

Table 3.3.

**Observation Schedule**

<table>
<thead>
<tr>
<th>Group</th>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Facilitated Meeting #1</td>
<td>January 29, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #2</td>
<td>February 26, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #3</td>
<td>March 11, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #4</td>
<td>March 21, 2013</td>
</tr>
<tr>
<td></td>
<td>Unfacilitated Meeting</td>
<td>March 25, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #1</td>
<td>January 30, 2013</td>
</tr>
<tr>
<td>B</td>
<td>Facilitated Meeting #2</td>
<td>February 6, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #3</td>
<td>March 6, 2013</td>
</tr>
<tr>
<td></td>
<td>Unfacilitated Meeting</td>
<td>March 13, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #4</td>
<td>March 27, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #1</td>
<td>January 30, 2013</td>
</tr>
<tr>
<td>C</td>
<td>Facilitated Meeting #2</td>
<td>February 11, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #3</td>
<td>March 5, 2013</td>
</tr>
<tr>
<td></td>
<td>Unfacilitated Meeting</td>
<td>March 25, 2013</td>
</tr>
<tr>
<td></td>
<td>Facilitated Meeting #4</td>
<td>March 27, 2013</td>
</tr>
<tr>
<td>All Groups</td>
<td>In-Class Unfacilitated Work Period #1</td>
<td>February 11, 2013</td>
</tr>
<tr>
<td></td>
<td>In-Class Unfacilitated Work Period #2</td>
<td>February 25, 2013</td>
</tr>
<tr>
<td></td>
<td>In-Class Unfacilitated Work Period #3</td>
<td>March 25, 2013</td>
</tr>
</tbody>
</table>

Observation was used to access the phenomenon of learning in context and to observe interactions between participants as well as other possible influencing factors such as cultural and physical tools. The value of observation in hermeneutic phenomenological research has been recognized by van Manen (1990) who pointed out that the method “generates different forms of experiential material than we tend to get with the written or the interview approach” (p. 68) and suggested that the most interesting type of material produced may be that of the “anecdote”; a specific type of story or narrative that has the power to “make comprehensible some notion that easily eludes us” (p. 116). The importance of observation for this research, in addition to other
data collection methods, is that much of the learning comprising students’ experiences of the Inquiry Project occurred at a rapid and pre-reflective level during their facilitated and unfacilitated work periods, and observation was a well-suited method for collecting data surrounding this notion.

The researcher who is involved in close observation is a gatherer of anecdotes. While conversational interviews and transcripts can be looked at for emerging themes “after one has gathered the material” (van Manen, 1990, p. 69), the challenge of collecting anecdotes through observation is that the researcher “has to recognize what parts of the ‘text’ of daily living are significant for one’s study while it is happening” (p. 69). This can make it challenging for the researcher to recall “what precisely was being said or what exactly happened” (p. 69) in the observed situation. As a result, van Manen suggests a process of recollecting where the researcher works to “recover those living phrases and incidents that give the anecdote a cogent power or point” (p. 69) by going back and retrieving the relevant information.

Observations are uniquely informative of participants’ lived experiences, yet they can also be somewhat problematic if the living phrases and incidents giving the moment its power of cogency are lost. Therefore, my method of observation attempted to balance these elements. During observational periods (facilitated and unfacilitated meetings), I positioned myself for “close observation” (van Manen, 1990) sitting within the meeting room just off to the side so as not to be within the conversational circle but also not so distant that I was no longer a member of the space. Throughout the meetings, I recorded field notes in the form of experiential anecdotes – narrative accounts of the interactions/dialogue between participants, non-verbal interactions, participant’s actions and behaviours, and the learning environment. When my own feelings and thoughts arose, I recorded my thoughts as an Observer Comment (OC) on separate lines from that of the experiential anecdotes themselves.
Experiential anecdotes were recorded during the observations by hand using a LiveScribe Smart Pen, which simultaneously captured my text as it was written as well as the audio being projected. A second tape recorder was positioned on the opposite side of the room as backup to the pen recording. Audio was collected so that living phrases and incidents of the situation could be recovered following the observation. This recovery involved two steps.

First, the written text was transferred from the LiveScribe Smart Pen to a Microsoft Word Document through a program called MyScript, which converts the handwritten notes recorded by the pen to electronic text (Figure 3.2). At this point the text was reviewed and corrected for any errors. An example of a correction is given in Appendix E where, on line 230, the word “as” is added to the sentence. This first step produced data reflective of the anecdotes recorded while the observation was occurring and before engaging in a process of recollection.

![Figure 3.2. Example of MyScript conversion. Handwritten notes (left) are converted to text (right).](image-url)
Second, the pen’s Pencast feature was used, allowing for notes and audio to be replayed together so that the user hears, sees, and revisits the notes as they were captured (LiveScribe, 2013). Pencasts were used to recall more precisely what was being said or what was happening within the room allowing for the initially recorded anecdotes to be enriched with the living phrases (i.e., verbal expressions) used by participants via transcription. Transcription was extensive but not exhaustive, as van Manen suggested anecdotes be constructed accounts “trimmed of all extraneous, possibly interesting but irrelevant aspects of the stories” (p. 69). Therefore, there were points in which the conversation was summarized and not transcribed verbatim.

As a result of these two steps, observation data came to consist of thick descriptions in the form of anecdotes as observed from my own perspective, yet also reflective of the cogent power of experiences as articulated through participants’ own words. Appendix E provides an example of this observation data. In this example, researcher-recorded anecdotes provide context and describe non-verbal actions such as reading and smiling, while the transcription from audio recordings provides verbatim recordation of the students’ dialogue.

Together these elements make comprehensible the rapid and pre-reflective learning occurring during students’ work periods while reflecting the lived experience as articulated. Data collected through observation was triangulated with interview data. Interview participants were asked about the observed encounters serving to prompt recall and awareness and allowing interviewees to verbalize, reflect, and explain their rationale on the pre-reflective moments of learning as experienced in the work periods observed. In addition to being utilized to prompt reflections, observations were used to gain an understanding of the learning occurring in context, to note the interactions between participants, and to observe the cultural tools used for learning.
**Interviews.** One-on-one interviews were conducted with the two interview student participants selected from each of the three groups, facilitator participants, and the lead facilitator participant (Table 3.4). Interviews were conducted by myself and were each conducted in small meeting rooms across the university campus.

Table 3.4.

*Interview Schedule*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Interview #1 Date</th>
<th>Interview #2 Date</th>
<th>Interview #3 Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyn (Group A)</td>
<td>January 21, 2013</td>
<td>March 1, 2013</td>
<td>April 8, 2013</td>
</tr>
<tr>
<td>Sue (Group A)</td>
<td>January 15, 2013</td>
<td>March 1, 2013</td>
<td>April 9, 2013</td>
</tr>
<tr>
<td>Heather (Group B)</td>
<td>January 18, 2013</td>
<td>March 4, 2013</td>
<td>April 5, 2013</td>
</tr>
<tr>
<td>Sam (Group B)</td>
<td>January 28, 2013</td>
<td>February 25, 2013</td>
<td>April 10, 2013</td>
</tr>
<tr>
<td>Caleb (Group C)</td>
<td>January 14, 2013</td>
<td>March 1, 2013</td>
<td>April 20, 2013</td>
</tr>
<tr>
<td>Jane (Group C)</td>
<td>January 14, 2013</td>
<td>March 1, 2013</td>
<td>April 9, 2013</td>
</tr>
<tr>
<td>FA (Facilitator, Group A)</td>
<td>April 4, 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FB (Facilitator, Group B)</td>
<td>April 20, 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC (Facilitator, Group C)</td>
<td>April 5, 2013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claire (lead facilitator)</td>
<td>April 16, 2013</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The interview method served two specific purposes aligned with a hermeneutic phenomenological methodology (van Manen, 1990): (1) it was used as a means for exploring and gathering experiential narrative material that might serve as a resource for developing a richer and deeper understanding of the phenomenon of students’ learning experiences of anatomy, and (2) it was used as a vehicle to converse with participants about the meaning of their experiences as learners of inquiry. A semi-structured and conversational interview approach was utilized - the
interview was based mainly upon pre-conceived questions designed by myself, however, probing questions and additional questions were asked for further elaboration of the conversation.

**Student interviews.** A total of three interviews were conducted with each of the six student interview participants, two participants from each of the three groups. These interviews spanned the length of the academic term and Inquiry Project. The first interview was conducted at the beginning of the term before the Inquiry Project began. The interview aimed to explore students’ previous learning experiences, their expectations for learning in the anatomy course, and their initial understandings of the Inquiry Project (Appendix F). The second interview was held halfway through the term/project between the students’ second and third facilitated meeting. This interview aimed to explore students’ experiences of learning within the first half of the project (Appendix G). Finally, a third interview was held at the end of the term/project after the final presentation had been completed. The third interview aimed to explore students’ experiences of learning in Inquiry Project overall (Appendix H).

**Facilitator interviews.** Each facilitator participant was interviewed once at the end of the term, when the Inquiry Project had been completed. The interview aimed to explore the facilitator’s experiences in leading their Inquiry Project groups and their perspective on their students’ learning experiences (Appendix I). Each of the three facilitators had facilitated three groups; one group included in this research and two groups who were not part of the study. This design provided the opportunity to compare between research and non-research groups for differences and similarities.

**Lead facilitator interview.** The lead facilitator was interviewed once at the end of the term, when the Inquiry Project had been completed. Across the term, the lead facilitator had worked closely with the facilitators and students to track the progress of the project. This individual regularly attended facilitated meetings to observe facilitators and students, distributed rubrics and communicated important dates, and collected feedback from students and facilitators.
throughout the term. As a result of their work, the lead facilitator was in a unique position to comment of the enacted Inquiry Project curriculum, the facilitator’s actions, and students’ experiences of the project as communicated through the feedback they collected. Therefore, an interview with the lead facilitator aimed to discuss the Inquiry Project and its curricular design as well as explore this individual’s perspective on students’ experiences across the term (Appendix J).

**Interview transcription.** All interviews were audio-recorded and transcribed by myself. A partially denaturalized transcription style was taken (Oliver, Serovich, & Mason, 2005). Denaturalized transcription attempts a verbatim depiction of speech but places emphasis on the meanings and perceptions being created and shared during a conversation, rather than upon the depiction of accents, involuntary vocalization, and response tokens (Oliver et al., 2005). Diction was corrected for (i.e., “Do you know what I’m sayin’” was transcribed as “Do you know what I’m saying?”), involuntary vocalizations were described in brackets (i.e., “(coughs)” or “(laughs)”), and response tokens (“yeah”, “mhm”, “hmm”) were included only when they contributed to or altered the meaning being conveyed through conversation.

An important aspect of the transcription style employed is treatment of the word *like*. While conducting interviews, it became clear that many participants used the word frequently, and that many times use of *like* detracted from the expressed meanings and perceptions being shared. Therefore, the transcription style had to provide a standardized way for recording participants’ use of *like* in a way that reflected the expressed meanings and perceptions being communicated.

In addition to the “proper” grammatical uses of the word *like* as a verb, noun, adverb, conjunction, and suffix, D’Arcy (2007) identified four vernacular uses and functions of the word all of which were used by participants regularly in conversation. First, *like* can be used as a quotative complementizer that functions to reflect the vividness of direct speech or thought.
(Romaine & Lange, 1991), for example, “I went up to him during like one of our time slots and he answered, he was LIKE ‘Oh, I think its going to be fifteen minutes’. I was LIKE ‘ok’” (I2.Lyn. 379). Secondly, it can be used as an approximate adverb to signify an estimation, for example, “I would take LIKE an hour break to work out” (I2.Lyn. 444). Third, it can be used as a discourse maker in replace of other words such as so, then, and well to mark discourse and information structure, for example, “well LIKE some people have had individual things” (I2.Jane. 64). Fourth, like can be used as a discourse particle that, while having no direct semantic meaning, serves important and palpable social functions in face-to-face interactions, i.e. “But nobody knows like actually what’s going on LIKE cellularly inside” (I2.Lyn. 69). The transcription style, therefore, maintained participants’ use of the word like in the first three ways where the word served an intentional purpose. However, it was often removed from transcription when it was used as a discourse particle. For example, the above verbalization would have been transcribed recorded as, “But nobody knows like actually what’s going on cellularly inside” (I2.Lyn. 69).

**Video recordings.** Each group gave a 15-minute presentation on their Inquiry Question and research at the end of the term. In addition to these presentations being observed by myself, the sessions were video recorded. The final presentation served as a potentially data-rich event as students presented a culmination of their work and expressed their learning in a variety of ways. Video recording these presentations, therefore, allowed for the repeated observation and review necessary for analyzing students’ experiences of learning as reflected in their final presentations. Table 3.5 summarizes the collection of video recorded data.
Table 3.5

*Video Recording Schedule*

<table>
<thead>
<tr>
<th>Group</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>March 27, 2013</td>
</tr>
<tr>
<td>B</td>
<td>April 3, 2013</td>
</tr>
<tr>
<td>C</td>
<td>April 2, 2013</td>
</tr>
</tbody>
</table>

**Artifact collection.** Throughout the project, various artifacts were used and/or produced by each of the groups. These artifacts included curriculum documents, Facebook and Google Docs artifacts, and personal goal reflections. Table 3.6 summarizes the collection of artifact data.

Table 3.6.

*Artifact Collection Schedule*

<table>
<thead>
<tr>
<th>Artifact</th>
<th>Source</th>
<th>Collection Date/Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Documents</td>
<td>Facilitator &amp; lead facilitator participants</td>
<td>Collection occurred across the term</td>
</tr>
<tr>
<td>Facebook Artifacts</td>
<td>Groups A, B, C</td>
<td>Collection occurred across the term</td>
</tr>
<tr>
<td>Google Docs Artifacts</td>
<td>Groups A, B, C</td>
<td>Collection occurred across the term</td>
</tr>
<tr>
<td>Personal Goals Reflection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflection #1</td>
<td>Students of Group A</td>
<td>February 15, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group B</td>
<td>February 15, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group C</td>
<td>February 11, 2013</td>
</tr>
<tr>
<td>Reflection #2</td>
<td>Students of Group A</td>
<td>March 11, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group B</td>
<td>March 29, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group C</td>
<td>March 13, 2013</td>
</tr>
<tr>
<td>Reflection #3</td>
<td>Students of Group A</td>
<td>April 8, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group B</td>
<td>April 8, 2013</td>
</tr>
<tr>
<td></td>
<td>Students of Group C</td>
<td>April 8, 2013</td>
</tr>
<tr>
<td>Peer Evaluation Rubric</td>
<td>Group A</td>
<td>February 26, 2013</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>February 15, 2013</td>
</tr>
<tr>
<td></td>
<td>Group C</td>
<td>February 11, 2013</td>
</tr>
</tbody>
</table>

**Documents.** The curriculum documents provided to students by the course director and/or lead facilitator, such as rubrics and handouts, were collected from participants.

**Facebook and Google docs.** As participants engaged in the Inquiry Project, each of the groups chose to create a private Facebook group and a Google Docs account for themselves where they could converse, share documents, and collaborate online. As groups used these tools
they created a variety of artifacts result from their work on the Inquiry Project: dialogue and conversation between group members (i.e., Facebook posts); rubrics as developed by the groups for their peer evaluation component of the Inquiry Project; research work completed by group members in investigating their Inquiry Question (i.e., documents including citations and annotated bibliographies); images, PowerPoint or Prezi materials, and presentation scripts created by groups for the presentation component of their Inquiry Project; and meeting minutes taken by group members on their facilitated and unfacilitated meeting times. Permission and access was granted from participants so that I could access these private Facebook Groups and Google Docs pages and collect the artifacts created by groups.

*Personal goal reflections.* For the personal goal component of their Inquiry Project, each student set a personal goal and composed reflections on their progress across the term. For the purposes of this study, these reflections were collected as artifacts once students had submitted their completed reflection to their facilitator. Collection of these reflections was achieved through the facilitator via photocopies or email.

*Peer evaluation rubric.* For the peer evaluation component of their Inquiry Project, groups designed their own peer evaluation rubric under the guidance of their facilitator. Groups used their rubric to assess their peers at the end of the term. For the purposes of this study, the peer evaluation rubric was collected as an artifact once the groups had submitted their completed rubric to their facilitator at the beginning of the term. Collection of these rubrics was achieved through the facilitator or student participants via photocopies or email.

**Ethical Considerations**

This study was approved for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen’s University ethics policies (Appendix K). This section discusses the ethical considerations given of this research including informed consent and voluntary participation, privacy and confidentiality, and security procedures.
Informed consent was gained from all participants through the participant recruitment procedures detailed previously. All participants were reminded that their participation in the study was voluntary and that they could choose to withdraw at any point. Avenues for withdrawal were detailed in the Letters of Information. To protect participants’ identities, each participant was de-identified/coded in all records and documents, thus blinding all others to participants’ identity. To protect participants’ identity, eye bars were added to any still images taken from videos. When frames or segments of video are used in publication or academic presentation of the research, participants’ identity will therefore be protected.

All electronic data files collected were saved on a laptop computer. The computer and related files are password protected. Additionally, files were backed up on an encrypted, password-protected external hard drive, which was stored in a locked office. All hard copies of data collected were stored in a locked filing cabinet located within the locked office.

In accordance with the Faculty of Education’s policy, data collected will be retained for a minimum of five years, after which point the data may be destroyed or retained indefinitely. When the data is destroyed, all electronic copies will be deleted and wiped clean from the laptop and external hard drive, while hard copies will be shredded and disposed of in a secure manner.

Analysis and Interpretation of Student and Group Experiences

My approach to data analysis was informed by methods suggested by various hermeneutic and phenomenological scholars (Colaizzi, 1978; Goulding, 2004; van Manen, 1990). For overall guidance on a process for data analysis, I consistently referred to Colaizzi’s (1978) phenomenological process as described in Goulding (2004):

1. Read narratives to gain a sense of the whole picture
2. Extract significant statements – identify key words and sentences
3. Formulate meanings from significant statements
4. Repeat process across participants’ stories to find and cluster recurrent meaningful themes
5. Integrate resulting themes into a rich description of the phenomenon under study
6. Reduce themes to an essential structure that offers explanation of the behaviour
7. Conduct further research to cross check interpretation

Steps 1-4 informed a process for producing results that describe overall group processes and individual students’ experiences. For additional guidance in completing steps 1-4, I referred to van Manen (1990) and his approaches for holistic and selective reading. Various forms of data – interview transcripts; facilitated and unfacilitated meeting pencasts and observation notes; and, students’ reflection artifacts as produced for their personal goals component – were read over in full and holistic themes were identified. Transcripts were then read a second time using a selective reading approach to identify students’ articulations that reflected the holistic theme. In analyzing students’ experiences during facilitated and unfacilitated meeting times, the pencasts (audio recording as pared with observational notes recorded by myself) were played back in full and holistic themes were identified through both listening and reading. Chunks of text were identified and recurring keywords were highlighted within the chunks to further understand and capture the meaning being communicated. At this point, Chapters 4-7 were written based upon the group and individual student experiences.

Descriptions of group and individual experiences were then analyzed for common themes. Once themes were identified, NVIVO was used to further analyze the data. NVIVO nodes were created for each of the developing common meaningful themes. Data was then analyzed and coded using such nodes. This coding process allowed common meaningful themes to be analyzed more consistently across participants. At this point, Chapter 8 (Common Meaningful Themes) was written. This process of writing achieved step 5 of Colaizzi’s (1978) phenomenological process. Overall, Steps 1-5 allowed for the first research question of this study
to be addressed. That is, data analysis led to the description and exploration of students’ experiences.

The second research question of this study related to comparing students’ experiences to a theoretical framework of authentic learning. Therefore, step 6 of Colaizzi’s (1978) phenomenological process aligned most closely with the process engaged for addressing this second research question. This process is more thoroughly described in the first section of Chapter 9. Finally, Step 7 was accomplished through a process of editing that involved consistently returning back to the data to review, compare, and edit the written text for further accuracy in reflecting the themes as identified.

**Data Citations Throughout Text**

Throughout the coming chapters, data is quoted and referred to. In such instances, quotes are cited so as to indicate its source. Citations follow a coding system established for indicating the specific type of data (interview transcripts, facilitated meeting transcripts and observational notes, peer evaluation artifacts, personal goals artifacts, etc.), the participant or Inquiry Group, and line number(s). Table 3.7 outlines a key of the coding system used to mark types of data.
<table>
<thead>
<tr>
<th>Data</th>
<th>Coding System</th>
<th>Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Interview Transcripts</td>
<td>I1/I2/I3.</td>
<td>“I” used to represent Interview. #1, 2, or 3 used to represent first, second, or third interview conducted with student participants. Line number(s) corresponding to specific point within transcript document.</td>
</tr>
<tr>
<td></td>
<td>Student Pseudonym.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line-Numbers.</td>
<td></td>
</tr>
<tr>
<td>Facilitator Interview Transcripts</td>
<td>I.Facilitator Pseudonym.</td>
<td>“I” used to represent Interview. No numbering system used as there was only one facilitator interview. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td>Facilitated Meeting Transcripts and Observational Notes</td>
<td>FM1/FM2/FM3.Group Letter. Line-Numbers.</td>
<td>“FM” used to represent Facilitated Meeting. #1, 2, or 3 used to represent first, second, or third meeting. Group Letter (A, B, or C) to represent specific group. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td>Unfacilitated Meeting Transcripts and Observational Notes</td>
<td>UFM. Group Letter. Line-Numbers.</td>
<td>“UFM” used to represent unfacilitated meeting data. No numbering system used as there was only one unfacilitated meeting observed per group. Group Letter (A, B, or C) to represent specific group. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td>Personal Goals Artifacts</td>
<td>PG1/PG2/PG3.</td>
<td>“PG” used to represent personal goals artifact. #1, 2, or 3 to represent a student’s first, second, or third submission. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td></td>
<td>Student Pseudonym.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line-Numbers.</td>
<td></td>
</tr>
<tr>
<td>Peer Evaluation Artifacts</td>
<td>PE.Group Letter. Line-Numbers.</td>
<td>“PE” used to represent peer evaluation artifact. Group Letter (A, B, or C) to represent specific group. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td>Final Presentation Video</td>
<td>Pres.Group Letter. Time Markers.</td>
<td>“Pres” to represent final presentation video. Group Letter (A, B, or C) to represent specific group. Time markers (i.e. 0:00-1:00) to represent specific point in video recording by minute and seconds.</td>
</tr>
<tr>
<td>Facebook Artifacts</td>
<td>FB.Group Letter. Line-Numbers.</td>
<td>“FB” to represent Facebook artifact. Group Letter (A, B, or C) to represent specific group. Line number(s) corresponding to specific point within document.</td>
</tr>
<tr>
<td>Google Docs Artifacts</td>
<td>GD.Group Letter. Line-Numbers.</td>
<td>“GD” to represent Google Documents artifact. Group Letter (A, B, or C) to represent specific group. Line number(s) corresponding to specific point within document.</td>
</tr>
</tbody>
</table>
Summary

In this chapter, I have detailed the methodological framework and methods employed for engaging in research. First, a methodology of hermeneutic phenomenology was discussed for the ways in which such an approach focused the research upon students’ experiences as lived. Second, methods for a case study research approach were presented, and steps taken for engaging in data analysis were detailed. In the following chapter, I describe the students and facilitators who participated in this study and outline their experiences of learning before beginning the Inquiry Project.
Chapter 4

Students’ Learning Experiences before Inquiry

This chapter begins with introductory and demographic information regarding the research participants from each of the three Inquiry groups. Following this, students’ experiences of learning before commencement of the Inquiry Project are presented. These experiences fall under two major categories: (1) past experiences of learning and, (2) understandings of the Inquiry Project before its commencement. This chapter concludes with a detailed account of the Introductory Lecture through which students were formally introduced to the project and its parameters.

Demographics

This section provides introductory and demographic information about each of the research participants as organized by group. Details such as students’ self-identified academic program of study, previous coursework, and career aspirations are presented.

Group A. Group A consisted of six students including two men (A.S1 and A.S3) and four women (A.S2, A.S4, Lyn, and Sue). Of the six group members, four students – A.S1, A.S2, A.S3, and A.S4 – where observed while the other two members – Lyn and Sue – were both observed and participated as interview participants.

All six of the students were in their second year of study within a Life Sciences program, of which the Anatomy Course was a required credit. Each student had previously taken the core courses of their program, which consisted of basic sciences courses such as first year Chemistry, Biology, Physics, Calculus, Physiology, and Anatomy. Each student had an elective credit in their first year of study, resulting in some variation in course selection, ranging from Cognitive Science to Philosophy. A commonly shared career aspiration amongst the students was the desire to
become a medical doctor. Table 4.1 summarizes each student and their academic program of study.

Table 4.1.

**Group A – Students and Their Academic Programs of Study**

<table>
<thead>
<tr>
<th>Student</th>
<th>Academic Program</th>
<th>Year of Study</th>
<th>Anatomy Course</th>
<th>Courses Taken Previously</th>
<th>Career Aspirations</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.S1</td>
<td>Life Sciences Specialization</td>
<td>2nd</td>
<td>Required</td>
<td>Core Courses*, Cognitive Science</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>A.S2</td>
<td></td>
<td></td>
<td></td>
<td>Core Courses*</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>A.S3</td>
<td></td>
<td></td>
<td></td>
<td>Core Courses*, Intro Anatomy</td>
<td>Psychiatrist</td>
</tr>
<tr>
<td>A.S4</td>
<td></td>
<td></td>
<td></td>
<td>Core Courses*, Intro Anatomy</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>Sue</td>
<td></td>
<td></td>
<td></td>
<td>Core Courses*, Intro Anatomy</td>
<td>Unknown</td>
</tr>
<tr>
<td>Lyn</td>
<td></td>
<td></td>
<td></td>
<td>Core Courses*, Gender Studies</td>
<td>Medical Doctor; Master’s studies in Public Health or Business studies</td>
</tr>
</tbody>
</table>

*Core Courses: First Year Chemistry, Calculus, Physics, Biology; Second Year: Anatomy, Organic Chemistry, Statistics, Genetics, Physiology

Since Lyn, Sue, and FA were interview participants, further introductory information is available about them, and follows in the next three paragraphs.

**Lyn.** Lyn was one of the interview participants from Group A. Lyn had a bubbly personality, describing herself as outgoing – a person who was not shy to talk, be loud, and share her opinions with others. At the outset of the winter term, Lyn had career aspirations to attend medical school and become a doctor. However, she described the goal as “almost impossible” (I1.Lyn. 33) and so, should her medical school aspirations not work out, she was considering a Master’s degree in Public Health or getting a Business degree. She thought this avenue might allow her to get into “the business side of pharmaceuticals or public health” (I1.Lyn. 36).

**Sue.** Sue was also an interview participant from Group A. Sue was a quiet and reserved student. Sue was a first-generation immigrant to Canada and spoke English as a second language. In her first interview, Sue thought she might enter into graduate studies after her undergraduate
degree was complete. When asked what area she pursue graduate studies, Sue said, “not sure yet. I will see”. (I1.Sue. 41)

**FA.** The facilitator for Group A was given a pseudonym of FA and will be referred to as such throughout this work. FA was the facilitator for Group A. She was a third-year Life Sciences student who had taken the Anatomy Course as a student the year before. This was FA’s first time serving as a facilitator for the Inquiry Project.

**Group B.** Group B consisted of four women (Sam, Heather, B.S3, and B.S4) and two men (B.S1, and B.S2). While most of the students in Group B were in their second year of a Life Sciences program, two exceptions are of note: (1) one student (B.S3) was a third year Biochemistry student who was taking the Anatomy Course as an elective credit, and (2) another student (Sam) was enrolled in a more general Life Sciences Program. The difference between the Life Sciences Specialization and general Life Sciences program as described by a participant is as follows: “With the specialization stream it’s more tailored to give students a greater number of lab hours to put us more in depth into the researching fields of sciences more than the Majors who tend to have a broader spectrum of things they can go into” (I1.Caleb. 32-35). Table 4.2 lists each student and details his or her academic program of study.
Table 4.2.

*Group B – Students and Their Academic Programs of Study*

<table>
<thead>
<tr>
<th>Student</th>
<th>Academic Program</th>
<th>Year of Study</th>
<th>Anatomy Course</th>
<th>Courses Taken Previous to the Anatomy Course</th>
<th>Career Aspirations</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.S1</td>
<td>Life Sciences Specialization</td>
<td>2nd</td>
<td>Required</td>
<td>Core Courses*, Psychology</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>B.S2</td>
<td>Life Sciences Specialization</td>
<td>2nd</td>
<td>Required</td>
<td>Core Courses*, Psychology, Microbiology, Molecular Biology</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>B.S3</td>
<td>Biochemistry</td>
<td>3rd</td>
<td>Optional</td>
<td>Chemistry, Biology, Genetics, Biochemistry, Main Group Chemistry, Chemical Kinetics, Methods of Structure Determination, Organic Relations, Statistics, Physical Biochemistry, Proteins and Enzymes, Metabolism</td>
<td>Unknown</td>
</tr>
<tr>
<td>B.S4</td>
<td>Life Sciences</td>
<td>2nd</td>
<td>Optional</td>
<td>Core Courses*, Psychology, Microbiology, Molecular Biology</td>
<td>Unknown</td>
</tr>
<tr>
<td>Heather</td>
<td>Life Sciences Specialization</td>
<td>2nd</td>
<td>Required</td>
<td>Core Courses*, Global Development Studies, Politics</td>
<td>Global Health</td>
</tr>
<tr>
<td>Sam</td>
<td>Life Sciences</td>
<td>2nd</td>
<td>Optional</td>
<td>Core Courses*, Sociology, Molecular Biology, Microbiology, Physiology, Nutrition</td>
<td>Write MCATs, Studies in a Mater’s or professional program such as Public Health programs and Occupational Therapy</td>
</tr>
</tbody>
</table>

*Core Courses: First Year Chemistry, Calculus, Physics, Biology; Second Year Anatomy, Organic Chemistry, Statistics, Genetics, Physiology*

Since Heather, Sam, and FB were interview participants, further introductory information is available on them, and follows in the next three paragraphs.

*Heather.* Heather was an interview participant from Group B. She described herself as a motivated and organized learner who took methodical approaches to assuring academic success. She expressed having high expectations of herself. At the outset of the winter term, Heather expressed a career goal of going into Global Health saying, “I’m not sure what the best road is to take this but that’s what I am interested in” (I1.Heather, 38-39).
**Sam.** Sam was also an interview participant from Group B. She described herself as an independent and studious individual who took a careful and meticulous approach to learning as a way to ensure she paid attention and absorbed information accurately. She struggled with procrastination and concentration in the face of highly demanding academic studies. Sam had interests in pursuing further education after completing her undergraduate studies. She had been investigating several different programs ranging from medical school, graduate studies in public health, and occupational health.

**FB.** The facilitator for Group B was given a pseudonym of FB and will be referred to as such throughout this work. FB was a third year Life Sciences student who had taken the Anatomy Course as a student the previous year. This was FB’s first time serving as a facilitator for the Inquiry Project.

**Group C.** Group C consisted of two men (Caleb and C.S3) and four women (Jane, C.S1, C.S2, and C.S4). All six students in Group C were in the second year of Life Sciences studies. As Life Sciences students, the students had completed similar courses in the basic sciences, however, they ranged in their selection of elective credits from Religious Studies to Cultural Issues. Table 4.3 lists each student and details his or her academic program of study.
Since Caleb, Jane, and FC were interview participants, further introductory information is available on them, and follows in the next three paragraphs.

**Caleb.** Caleb was an interview participant from Group C. At the time of this study, Caleb was a second-year undergraduate student studying within a Life Sciences Specialization degree. Caleb described himself as being “a semester ahead of everybody else” (I1.Caleb. 68). Upon entering his undergraduate studies, Caleb had been allowed to transfer credits from previous studies towards his studies in the Life Sciences program. This meant that Caleb could take 200-level courses, such as Statistics, Physiology, and Organic Chemistry in his first year of study when they would normally be taken in a student’s second year. By the time Caleb took the Anatomy Course with his second-year peers, he had already completed many of the courses that his peers would be taking the following year. For example, in addition to the Anatomy Course, Caleb was enrolled in third year courses including Pharmacology, Epidemiology, and an Integrated Laboratory Course.
Caleb described himself as an only child who was accustomed to quiet personal time. His ultimate goal in life was success – “I want success in being a productive member of society. I want success in making my parents proud in doing well in my studies. Or rather, I hope to gain this success” (PG1.Caleb. 7-8). Caleb identified himself to be a studious perfectionist who prided himself in being academically successful. After completing his undergraduate degree, Caleb had an interest in attending Medical School. Despite this goal, Caleb expressed stress around his ambitions. He described his goal of attending Medical School as “nerve-racking” (I1.Caleb. 44) and had other career interests of doing a Master’s in Epidemiology and a PhD in Preventative Medicine or Public Health in an effort to “circumvent a nervous breakdown” (I1.Caleb. 47) should he not be accepted.

Jane. Jane was also an interview participant from Group C. Jane described herself as an independent learner who preferred aural forms of learning, such as listening to her professor’s lectures. Jane felt her studies placed incredible demand on her both academically and mentally. She maintained an array of extracurricular activities while also being a high achiever. At the outset of the term, Jane had career interests in medicine but recognized that she was beginning to hear and learn about other options that she would be looking into.

FC. The facilitator for Group C was given a pseudonym of FC and will be referred to as such throughout this work. FC was a fourth year Life Sciences student who was completing an honours specialization degree, which involved a fourth-year research project with a focus on cancer research. FC had been a student of the Inquiry Project two years prior (in 2011). She had served as a facilitator in 2012 and was serving for the second time in 2013.

Students’ Experiences before Inquiry

Students’ prior learning experiences were sought in an effort to reveal their perspectives and attitudes towards learning before engaging in the Inquiry Project. For interview participants, this was collected through the initial interview conducted before the Inquiry Project began. For
non-interview participants, this information was collected indirectly through written reflections as recorded for the first personal goals reflection submitted as the project began.

Interview participants’ experiences. I met with each of the six interview participants (Lyn (Group A), Sue (A), Heather (B), Sam (B), Caleb (C), and Jane (C)) for their first interview prior to the commencement of the Inquiry Project. This interview was an opportunity to discuss the students’ past educational experiences and their understanding of the Inquiry Project before its commencement. Themes that emerged of each student’s experiences, based on our conversations, are presented here.

Lyn. On January 21st Lyn and I met for her first interview. From analysis of the first interview transcript two major themes emerged of her experiences of learning leading up to the Inquiry Project.

Past academic studies as largely memorization. In describing herself as a learner Lyn said, “I’m an applied learner. I like doing questions. Having the questions there […] I have to use it in situations. I can’t just memorize.” (I1.Lyn. 184-185, 190-191). Yet at the outset of her winter term, Lyn described her second year studies as “just memorization” (I1.Lyn. 124) and described anatomy in particular as “pure information memorization” (I1.Lyn. 133). Elaborating on her past experiences and her learning goals for the term ahead, Lyn said:

I understand anatomy as just information. [In the fall term], I just think a lot of it didn’t really absorb […] so my goal is to really improve on [the midterm and final] and I am going to try different methods of studying and hopefully more group studying. […] So that would be my goal…improve on those tests. (I1.Lyn, 290-291, 294-297)

Lyn’s goals for the term ahead were motivated by the external factors of grades and academic performance. She aimed to develop learning strategies, such as using cue cards, which would aid her in preparing for and performing well on examinations.
Getting the gist of inquiry. Before the Inquiry Project began, Lyn sensed that the Inquiry Project would offer something different from the common experience of memorizing and absorbing information. Lyn felt that she and her colleagues were so accustomed to absorbing information that the upcoming Inquiry Project was an intentional attempt to engage students in an alternative learning experience:

We are just so used to absorbing information, we are not used to like actually having to think of stuff ourselves (laughs) so I think that’s why, that’s why [Prof] is doing it though is to get us like out of our comfort zone. (I1.Lyn. 331-334)

Lyn attributed her understanding of the project to a conversation she had engaged in with an upper year student before the Project was formally introduced in class:

Originally I had no clue what [The Inquiry Project] was about because [the professor] didn’t really explain it, but I talked to a fourth year [student at the gym]. She kind of told me about it and just told me that, really all [Prof] wants is for you to be creative, he is not really looking for you to just like lay out concrete information or see how much you know. She said it’s more about presenting, your teamwork skills, and how you can get creative with anatomy […] so after telling me that I was like ‘oh I kind of get the gist of it’, it’s kind like of getting creative like but incorporating anatomy into kind of like a project, just explaining it. (I1.Lyn, 305-310, 314-316)

This peer-to-peer conversation both introduced Lyn to the structure and expectations of the project and instilled confidence in her ability to complete the project successfully: “I feel like because that fourth year life sci told me like her kind of topic I got the gist of it. […] I am excited - I love presentations. A lot of people might hate it but I love (laughs)… I’m excited” (I1.Lyn, 326-327, 335-336). Despite her confidence, Lyn believed that many of her classmates did not share the same clarity: “I feel like everyone was super confused at first […] I am not sure if other
people know what kind of topics to choose, I feel like they are kind of lost” (I1.Lyn, 324, 327-329).

Sue. From Sue’s first interview, conducted on January 15th, 2013 two holistic themes emerged of her learning experiences and understanding of Inquiry.

‘I like to explore stuff on my own’. Sue described herself as an independent learner who was successfully adjusting to undergraduate studies. Despite her success, Sue wished that her professors would slow down and reduce the amount of content covered in courses so that she could spend time “on more understanding and important stuff, not just explaining” (I1.Sue. 236-237). While focused on the content being presented within her courses, Sue also enjoyed exploring and learning more about topics that interested her:

I like to like explore stuff on my own. Like sometimes even if we are not being tested I can, if I am interested, I will look up on the internet and explore a bit more but yea…. So on my own, independently. (I1.Sue. 123-125)

In regards to the upcoming Anatomy course in particular, Sue said she had no real expectations about the course and what she would learn but said, “I just learn whatever is presented and sometimes go in a little bit depth by myself” (I1.Sue. 244-245).

A basic understanding of inquiry. Before being introduced to the Inquiry Project, Sue felt she had a basic understanding of the project. She was hopeful and positive about the upcoming project as an opportunity for students to teach themselves: “Just from what I understand it’s like students teaching themselves so it sounds pretty good because students actually know like what other students are concerned with about their learning styles and stuff so it sounds pretty good for me” (I1.Sue. 339-341).

Heather. I met with Heather for her first interview on January 18th, 2013. From analysis of the first interview transcript, two major themes emerged which are discussed below.
Trained to write multiple-choice exams. Heather described herself as an adaptable learner who had trained herself to apply certain learning strategies in order to succeed on multiple-choice exams. “I like know what works for me, I know what doesn’t and I like, stick to what I know works well for certain types of exams and types of assessments” (I1.Heather. 105-106). Heather expressed an interest in tutorial- and discussion-based learning, however, when asked how she would prefer to learn, Heather returned to expressing a preference for multiple choice exams: “I’ve been trained to do multiple choice exams so that’s what I would excel at because that’s what I’ve been trained to do and that’s how I’ve learned to study for” (I1.Heather. 196-198).

Expectations of anatomy and inquiry. Heather expected to come away from the Anatomy Course with “a better understanding of human anatomy” (I1.Heather. 270) and expected that the course would be similar to previous courses, which had consisted of lectures, multiple-choice exams, and laboratory learning. When asked about her understanding of the upcoming Inquiry Project, Heather said, “I really don’t know much about it yet, we haven’t talked much about it. I like kind of understand that it might be some sort of research project, but I don’t really know much beyond that” (I1.Heather. 282-284).

Sam. I met with Sam for an initial interview on January 28th, 2013. Analysis of the transcript from this interview produced two themes.

Learning strategies for demanding courses. As highlighted above, Sam spoke of her academic studies as demanding and strenuous. She described long days of content-heavy lectures that made it difficult to pay attention and retain the information being taught: “There is just so many lectures, and the lectures cover a lot more material in a lot more specific way that, even though when I like listen to it, like sometimes I can’t even concentrate on all of it um if it has been a long day and it doesn’t retain as well” (I1.Sam. 156-159).

In light of this, Sam based her learning strategies upon each course and the material being covered. Some courses, such as nutrition, she described as “straight out memorization” (I1.Sam.
and used cue cards to study. Other courses such as math and chemistry “were more understanding” (I1.Sam. 73) and so Sam studied using practice problems. When asked to describe her anatomy studies Sam said, “Anatomy was mostly also memorization, doing the labs, reviewing, and then going through again with the questions and seeing if I do understand it, that sort of thing” (I1.Sam. 76-78). At the outset of the Anatomy Course, Sam had a goal to improve her grade:

I am hoping to learn from [the anatomy course last term] and work more, study more on details and have a full understanding of it before actually going into the test. I found that, a lot of the time, in [last term’s course] I felt confident in the material but I still didn’t get the mark I wanted […]. So I think this semester I am going to focus a bit more on details because I think it was a lot of details. (Sam, 1, 251-254, 264-266)

The project as a scary mystery. Before the Inquiry Project began, Sam felt she understood very little about the project and what was going to be expected of her. She commented that “it seems like [the project] has been kept a mystery to us” (I1.Sam. 278-279). While Prof had mentioned the project at the outset of the course, he “kept talking about it but he never like really explained to us - what’s going to happen to it other than the fact that it’s student-directed learning” (I1.Sam. 279-280). From the initial details provided, Sam had deduced that the project would be a group project and that she would be expected to work with others. She commented that:

Group projects kind of scare me sometimes because […] you don’t know who you are working with and you don’t know whether they work the same way as you or if they are willing to do things like your way or their way kind of thing. (Sam, 1, 284-298)

Despite this attitude, Sam trusted that her group would be able to figure things out and help each other through the course. She trusted that she would learn more about what was expected of her as the project got started.
Caleb. I met with Caleb for his first interview on January 14th, 2013. The following two themes emerged from our discussion.

Adjusting approaches to learning. In his second year of study, Caleb found himself working to adjust his approaches to learning in response to his first-year experiences. He had a desire to circumvent the stress he had felt in his first year in order to improve his academic performance and apply his learning. Reflecting on his first year, Caleb said, “I stayed in the library most of the time and I used to just read and read and memorize my notes” (I1.Caleb. 80-81). This approach had become overwhelming for him, particularly when he procrastinated and left studying to the last minute. In response, Caleb was working to change his approach to learning by engaging with the content more. For example, he would review his notes after class, converse with others, and seek out opportunities to practice or get hands-on experience with the material. In describing the revelations he had recently made of his own learning, Caleb said:

You read something, you memorize it, you understand it, you see the diagram – but it makes a lot more sense and it sort of sticks a lot better in your head if you see how it actually works or how the thing actually functions, that sort of thing. And, like if you discuss it with people, like scientific conversations with your TAs or the Professor or with other students, ask questions together – that problem solving also helps a lot. (I1.Caleb. 105-110)

The adjustments Caleb was making to his mentality and practice of learning were reflected in his attitude towards the Anatomy Course and his intentions for learning. He had an intention to be successful, “I would say obviously I want to do well” (I1.Caleb. 214) but in addition to this, Caleb wanted to go into the course with a positive attitude:

I want to learn new things, because it’s actually fascinating. Like things that you take in that course are things that you apply on a daily basis so if you go in that just wanting to know what goes on in the body, you’ll learn and you will do well. (I1.Caleb. 218-221)
The Inquiry Project is mysterious. Caleb explained that many of his classmates were going into the Anatomy Course with “a negative attitude” (I1.Caleb. 216) because they were intimidated about the Inquiry Project. He described the project as having a mystique or suspense around it because:

Nobody really knows what it is yet. We’ve talked about it to other like upper years that are just like ‘It’s a project, you know, research whatever’. But I don’t think a lot of people have done that much research and everyone’s just freaking out because Prof still hasn’t told us what it is. (I1.Caleb. 226-229)

Despite this, Caleb maintained a positive attitude towards the project. He said, “I am just assuming it’s something like, based on what we know or what we don’t know, we design a research question, we design a study in whatever form” (I1.Caleb. 248-250). Caleb had confidence in his ability to manage such a project, based the work he had previously completed in other courses.

Jane. I met with Jane on January 18th, 2013. Based on an analysis of the interview the following three themes emerged of Jane’s experience leading up to the project.

Learning to learn. In reflecting on her past learning experiences in first and second year, Jane talked of how she had been learning how to learn. In doing readings for her Philosophy course, Jane realized that she could learn both the material itself as well as “learn how to learn this type of material” (I1.Jane. 185-186). Reflecting on her performance in the anatomy course she took in the previous fall term, Jane said “I know that last semester I definitely did focus more on just trying to remember all of the information because it was all new and it was things that seemed at first like it would be common knowledge” (I1.Jane. 245-247). While this approach had gotten her through the course, Jane wanted to take a deeper approach to her learning in the term ahead. She wanted to review the material more frequently because: “that would help to give me the opportunity to think about what I’ve learned and then focus more on understanding and bring
“it all together” (I1.Jane. 251-253). Overall, Jane said she had a goal for the Anatomy Course to “understand it better by changing how I learn” (I1.Jane. 254).

**Academic pursuits measured by interest.** When Jane spoke of her academic studies so far and the decisions she was making about her studies, she consistently referred to her interests as a guiding factor. While Jane was currently enrolled in the Specialized Life Sciences program, she wanted to change to a Major in Life Sciences with a Minor in Philosophy. This decision had been informed by her interests:

I wanted to add something a little, like I guess, an extra personal interest to what I was studying. Especially because I saw that there were a lot of courses in Biomedical Ethics, which I found to be a really good supplement to the factual information that we’re learning in [the Life Sciences program] but to add to it more of like a real world context, I thought would be interesting. (I1.Jane. 32-37)

For Jane, the Basic Science courses she had taken in her first and second year were introductory and described them as “good courses but nothing too interesting” (I1.Jane. 60).

**I like all the buzzwords.** When asked what she knew of the Inquiry Project so far, Jane said she had heard about it but was “not exactly sure what it is” (I1.Jane. 268). She had read an introductory description available to her through the course online learning management system and described it to me as “discovering things before they’re really explained to you” (I1.Jane. 263-264). She understood the project to be about discovery, self-directed learning, and teamwork, and said “I like all of the buzzwords that are used in it, it seems like something that would be interesting and different than the way we learn in a lot of other courses” (I1.Jane. 264-266).

Overall, she was intrigued at the possibility of trying to determine for herself “what I think is significant or interesting from what we were learning and sort of focus in on that and use what I am learning to answer that question” (I1.Jane. 295-296).
Non-interview participants’ experiences. The remaining twelve students, who participated in the study but did not participate in the interview component, did not have the opportunity to share their experiences in the same way as Lyn, Sue, Heather, Sam, Caleb, and Jane. However, many students commented on their past educational experiences or understanding of the Inquiry Project within their first written reflection submitted for their personal goal component of the project. Therefore, this data was used to formulate results around non-interview participants’ experiences of learning before the Inquiry Project began. Submission of these reflections occurred after the students had been fully introduced to the project, however, their comments are worth consideration here as evidence that their experiences were much the same as their interviewed peers.

Past educational experiences: academic program, success, and stress. Through their written reflections, non-interview participants shared their perspectives on past educational experiences to highlight their academic program, their performance and success, as well as their feelings of stress.

Some students commented on their past educational experiences highlighting how it had historically lacked group work. For example, one student wrote, “As a major in Life Sciences hasn’t involved group work in the past, I have not had the opportunity to actively work on responding to constructive criticism in an academic environment” (PG1.CS1. 5-7) indicating that their program of study had been individualistic in nature.

Students regularly spoke of their academic performance, specifically commenting on tests/exams, memorization as a learning strategy, and grades as a measure of success. For example, CS3 described how evaluations were often “based solely upon our ability to regurgitate information memorized from lectures” (PG1.CS3. 28-29). Closely related to these comments, were comments about procrastination and feelings of stress. For example, BS4 identified procrastination as a big problem because it “negatively impacts my grades, especially in courses
such as [the Anatomy Course] where the sheer volume of information is impossible to memorize in a single night” (PG1.BS4. 9-10). CS2 also spoke of procrastination, stress, and the desire to “feel better prepared for tests and exams” (PG1.C.S2 10).

Finally, students described having heavy workloads, maintaining a wide range of academic and extra-curricular activities and commitments. For example, A.S4 said she “thrived on being busy” (PG1.A.S4 5) with schoolwork, extra-curricular activities, sports, hobbies, and social time with friends so much so that she felt she had become “too busy to keep up with schoolwork” (PG1.A.S4 8-9). B.S1 described school, volunteer, and athletic obligations that made it difficult to keep up with his studies without feeling stressed.

Overall, students’ comments from their personal goal reflections reinforce and expand understandings of participants’ experiences of learning prior to commencement of the Inquiry Project. Like their interviewed peers, non-interviewed participants, identified their program of study as historically lacking group work opportunities. They spoke of grades and academic performance of exams as motivational factors in learning, cited memorization as a predominant learning strategy, and expressed how stressed they felt in managing academic and extracurricular responsibilities.

_current understandings of inquiry: a unique opportunity for group work and research._

Through their written reflections, many non-interview participants also commented on their understandings of the Inquiry Project. BS2 described the Inquiry Project as a “unique opportunity” (PG1.BS2. 2) to engage in group work, research, and prepare a presentation: “I feel like this is the first project we have had since high school where we are presenting in front of people” (FM1.B. 102-103). AS3 commented that the project “provides students the opportunity to collaborate in a small group environment and present findings on a topic of interest related to anatomy” (PG1.AS3. 1-2). BS1 described the project as an outlet to further their understandings and engage in academic research. These examples highlight how the students initially understood
the Inquiry Project as an opportunity to learn in a different way through group work, research, and presenting – forms of learning that they had not yet experienced at the undergraduate level.

Such comments were made after the students had been exposed to formal introductions such as the Introductory Lecture and the first facilitated meetings (described in upcoming sections and chapters). In comparison to their interviewed counterparts who were interviewed before these events, non-interview students were more familiar with the project when their comments were made. Regardless, their comments highlight initial understandings of the Inquiry Project.

**Summary of students’ experiences prior to the inquiry project.** Overall, the above sections have reported upon students’ experiences of learning prior to their engagement in the Inquiry Project. With the exception of one participant (B.S3), student participants were second year undergraduate sciences students who were working to adjust their learning strategies with the academic demands of post-secondary studies. Students aimed to developed approaches to learning and studying that would enable them to succeed. Memorization strategies predominated due to the demanding, content-heavy nature of their course work.

In regards to the upcoming Inquiry Project, students reported to know very little and described the project as mysterious. However, elaborating upon their understandings students sensed the project would involve group work and research. In general, students were looking forward to the project as an opportunity to learn in a different way than their other courses or projects might allow.

**Introductory Lecture**

On Monday January 21st, 2013 students of the Anatomy Course had a regularly scheduled lecture 50 minutes in length. Prof used this lecture time to introduce the class to the Inquiry Project. What follows is a description of this event.

The large lecture hall began filling up with students and the room became busy with chatter and movement. The intention of this session was to introduce the Inquiry Project to the
Before this point, initial information about the project had been available through details in the course syllabus or through materials posted on the course’s online learning management system. However, this session was to serve as the first formal introduction to the project and its elements. At the outset of the session, Prof displayed the following paragraph by overhead:

[The Inquiry Project] introduces a concept of “discover first, explain later” into the curriculum. This inquiry-based learning strategy focuses on students taking the lead in their own learning and it is built into their larger program structure, goals and plans. The students are actively involved in the planning, development and evaluation of their activities. The students generate an anatomical based question (discover first) and launch their individual inquiries (explain later) in small groups. This project allows the students to track their growth and make judgments about their achievements. However, and more importantly than the anatomical knowledge gained, is the process established and followed to gain this knowledge and furthermore to disseminate this to their peers. These skills, personal and group based that you develop and improve upon will follow you throughout the rest of your life. (IL. 30-40)

Prof then spoke about the project, drawing upon the overhead text to elaborate on particular aspects. He first elaborated on students taking the lead on learning, as he said:

I want to highlight some significance here, […] students taking the lead in their own learning. This is entirely a student-led and a student-driven initiative. You will have facilitators, you will have myself for guidance but what you are going to hear from myself, as well as Claire, and your facilitators is, they are probably going to answer your questions with a question because this is student-led and student-driven. You are responsible for really everything here. (IL. 50-55)

Next, Prof pointed out the following sentence in the overhead paragraph: “the students are actively involved in the planning, development and evaluation of their activities” (IL. 55-56)
and further emphasized this by saying, “You are responsible for a lot of what the end result is going to be. And what is the end result? 15% of your final [Anatomy Course] grade” (IL. 56-58).

Finally, he read the remainder of the overhead paragraph and said:

This a very, very powerful statement and in reality I am not really concerned how much anatomy you learn through this initiative but it’s these other skills perhaps really honing on your skills to work as a group, or we will talk about personal goals in a few minutes, to better yourself in some way. That will – and trust me – go with you in every step of your journey after you leave [the Anatomy Course], finish the rest of your undergraduate degree program, and wherever you go beyond that. This will pay dividends, trust me.

(IL. 66-73)

Prof then went on to explain how the Inquiry Project was to be structured, explaining that students had been organized into groups of six, each group had been assigned a facilitator, and that their facilitator would be in touch to arrange their first facilitated meeting within the week. He explained that there would be four facilitated meetings across the term, during which time groups would meet with their facilitators. He specified that three class periods had been scheduled as formal time dedicated to the Inquiry Project for the students to use.

Next, Prof explained how the project would be evaluated, describing each of the four components of the project used to calculate the 15% of students’ overall Anatomy Course grades. To do so, he put up a second overhead to display a table outlining the four components (Figure 4.1).
**Figure 4.1.** Overhead outlining the Inquiry Project’s four types of evaluation.

<table>
<thead>
<tr>
<th>Type of Evaluation</th>
<th>Expectations/Requirements</th>
<th>Submission Details</th>
<th>Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Evaluation</td>
<td>I will compose my own personal learning goals, things I wish to work on or achieve throughout this learning experience.</td>
<td>Annotated list or written document of my goals due to my Facilitator at the beginning of our Second Meeting. The specific date as determined by the group.</td>
<td>__/25</td>
</tr>
<tr>
<td>Peer Evaluation</td>
<td>As a group, we will create our own peer evaluation form. We will base this form on what we, as peers, deem important measures of individual contribution and success so that we may assess one another on these measures at the end of the term.</td>
<td>A copy of our created evaluation form due to our Facilitator at the beginning of our Second Meeting. The specific date as determined by the group.</td>
<td>__/25</td>
</tr>
<tr>
<td>Group Process</td>
<td>As a group, we will provide evidence to our facilitator of our growth and advancement so that the facilitator may accurately assess our progress.</td>
<td>Ongoing throughout the term through communication with our Facilitator submission of concise evidence as appropriate.</td>
<td>__/25</td>
</tr>
<tr>
<td>Presentation</td>
<td>Together as a team, we will present our research project to the class.</td>
<td>10 minute presentation on 1 of 3 presentation days (Monday March 26th, Thursday March 29th, or Wednesday April 5th).</td>
<td>__/25</td>
</tr>
</tbody>
</table>

The remainder of the session was focused on emphasizing how student groups might devise their Inquiry Question and be creative with their final presentations. To explain how groups might formulate a question, Prof suggested:

For your first meeting, each of the six members start thinking on an idea in anatomy, an anatomy-based idea, that they can present for discussion with their peers in their group and collectively the six of you’s will have six ideas that you have to narrow down to one that you want to pursue that is of interest to everybody. (IL. 189-182)
To emphasize being creative with the presentations, Prof explained that:

The presentations – even though they have to have content and they have to be informative, [...] be entertaining as well. You are not up here to be comedians but to capture the interest and engage your audience you have to be somewhat entertaining. (IL. 179-181)

Prof and Claire both shared some examples from past years, highlighting how groups have performed skits or made music videos to express their ideas in a creative and entertaining way. To finish the session, Prof encouraged students to complete a feedback page where space was provided to record outstanding questions they had about the project.

After the introductory session, facilitators got in touch with students to arrange a time for their first facilitated meeting. From this point onwards, students engaged in the project within their assigned groups. The following chapters (5 to 7) focus on telling stories of how each group and individual students within each group engaged in the Inquiry Project.

**Chapter Summary**

In this chapter, I focused on students' experiences before beginning the Inquiry Project. The chapter began with a presentation of participant demographics, then presented results from initial student experiences of learning before the Inquiry Project began. In the final section of this chapter, I described the Introductory lecture that introduced students to the project.

The following chapters, Chapters 5 to 7, are dedicated to each of the three Inquiry Groups who participated in this study (Groups A, B, and C). In these chapters, I describe the inquiry process engaged by each group, as well as the peer evaluation and personal goals components of the project. Throughout the chapters, vignettes from participants offer insight into their experiences of learning and engagement.
Chapter 5

Group A

This chapter focuses on Group A – how the students engaged in their group work and made progress on the project, as well as the experiences of group members throughout their engagement. To review, Group A consisted of six students including two men (A.S1 and A.S3) and four women (A.S2, A.S4, Lyn, and Sue). All six of the students were in their second year of study within a Life Sciences program. Group A’s facilitator, FA, was a third-year Life Sciences student who had taken the Anatomy Course as a student the year before. This was FA’s first time serving as a facilitator for the Inquiry Project. Study participants Lyn and Sue were interviewed throughout the term. Additionally, FA was interviewed at the end of the term.

Table 5.1 summarizes Group A’s engagement with the project, organizing the work into three categories: (1) the inquiry process itself – inquiry topic, question, research, and presentation; (2) the personal goals component; and (3) the peer evaluation component of the project. The Inquiry Process is further organized into seven stages as based on the group’s activities and actions: getting started, organizing research, question formation, distributed collaborative work, presentation development, presentation rehearsal, and finally, the presentation itself. These stages were author-derived based upon observation and data analysis of the activities and actions Group A engaged in throughout the project.

In this chapter, the group’s inquiry process and its seven stages are presented. Following this, the personal goal and peer evaluation components are discussed. Throughout these sections, vignettes of Lyn, Sue, and FA’s experiences illustrate these individuals’ lived experiences of the project. Finally, the chapter concludes with a consideration of Lyn, Sue, and FA’s reflections of the project once it was complete.
### Table 5.1.

**Summary of Group A’s Process**

<table>
<thead>
<tr>
<th>Dates</th>
<th>Meetings</th>
<th>Inquiry Process</th>
<th>Personal Goals</th>
<th>Peer Evaluation</th>
</tr>
</thead>
</table>
| Jan. 29| Facilitated Meeting #1 | **Getting Started**  
- Clarified roles, goals, and expectations for the project  
- Brainstormed ideas for the Inquiry Question |  
- Instructions from FA on expectations  
- Brainstormed ideas |  
- Instructions from FA on expectations |
| Feb. 11| In-Class Period #1  | **Organizing Research**  
- Selected an idea from brainstormed questions  
- Selected sub-topics for further investigation  
- Divided work based on three sub-topics selected, with two students pairing up to work on each |  
- Submitted first personal goals reflection to FA |  
- Construction of peer evaluation rubric |
| Feb. 25| In-Class Period #2  | **Question Formation**  
- Developed a broad research question that expressed the selected topic and sub-topics  
- Developed a timeline for research based on direction |  
- Feedback from FA on submitted personal goals reflections |  
- Submitted peer evaluation rubric to FA |
| Feb. 26| Facilitated Meeting #2 | **Distributed Collective Work**  
- Conducted research work individually and in pairs  
- Met to share, compare, and discuss the understandings each research pair has developed through research work |  
- Submitted second personal goals reflection to FA |  
- Submitted peer evaluation rubric to FA |
| Mar. 11| Facilitated Meeting #3 | **Presentation Development**  
- Set goals for creative development of presentation  
- Individuals and pairs prepared PowerPoint slides to communicate their research and sent this information to A.S1 who built the Prezi Presentation |  
- Submitted third and final personal goals to FA |  
- Submitted completed peer evaluation rubrics to FA |
| Mar. 21| Facilitated Meeting #4 | **Presentation Rehearsal**  
- Rehearsed presentation  
- Further reduced presentation material |  
- Submitted completed peer evaluation rubrics to FA |  
- Submitted completed peer evaluation rubrics to FA |
| Mar. 24| Unfacilitated Meeting | **Presentation**  
- Gave presentation |  
- Submitted completed peer evaluation rubrics to FA |  
- Submitted completed peer evaluation rubrics to FA |
| Mar. 25| In-Class Period #3 | |  
- Submitted completed peer evaluation rubrics to FA |  
- Submitted completed peer evaluation rubrics to FA |
| Mar. 27| Presentation Day | |  
- Submitted completed peer evaluation rubrics to FA |  
- Submitted completed peer evaluation rubrics to FA |
| Apr. 5 | | |  
- Submitted completed peer evaluation rubrics to FA |  
- Submitted completed peer evaluation rubrics to FA |
The Inquiry Process

**Getting started.** To begin Group A’s Inquiry Project, FA arranged to meet with Group A for their first facilitated meeting. She booked a group study room within a campus library and emailed the group. In the hour preceding this meeting, the students arranged an informal meet-and-greet at a campus coffee shop. From there, they walked over to the library together for their facilitated meeting. FA started the meeting by asking each person to introduce him or herself through an icebreaker activity.

Following introductions, FA led the group in a discussion about the project and its four components – personal goals, peer evaluation, group process, and the final presentation – and students asked questions to clarify their understanding of the expectations. It was reinforced that, in addition to getting started on their inquiry investigation, students were required to select a personal goal and compose their first personal goal reflection due to FA within the week. It was also clarified that the group’s members were expected to collectively construct one peer evaluation rubric due to FA by the second facilitated meeting.

After discussing and clarifying the various components of the project, FA initiated a discussion about the Inquiry Question itself by asking the group if they had thought of any ideas for their topic. The students told FA of their coffee meeting and explained that during that time they had already begun to share ideas with one another. The group then continued to brainstorm ideas around topics they might focus on. The following observational note was made of the conversation:

A.S2 expresses that she thinks it would be entertaining if they were to keep the idea related to something from social media, “Like you could pick something from a childhood show and say why it’s not possible – like even Barbie… like why…?” When S2 says Barbie the group gets really excited saying “Oh that’s a good one!”，“Good
idea!” One student hits the table with their hand and says, “Done!” Some group members laugh. (FM1.A. 359-365)

As the group continued to talk about Barbie, they shared what they knew about Barbie’s anatomical design. For example, A.S4 commented, “If Barbie was real life she would be so disproportioned” (FM1.A. 372-373). Overall, they considered how the Barbie doll does not accurately reflect normal anatomical proportions of the human body. Lyn wondered if this might be explained through exploring the anatomical effects of eating disorders such as anorexia and bulimia.

Despite the group’s initial enthusiasm about this topic, multiple ideas were generated as each member contributed ideas, and so, as the first facilitated meeting came to an end, the group agreed that they would post their generated ideas to a private Facebook group and vote on the topics they liked the most. In the days following the meeting, each group member voted and the group collectively elected to focus on the Barbie idea. While Barbie’s body served as the general topic of focus, the group selected three sub-topics to explore further: Barbie’s anatomical disproportions; the impact of eating disorders, specifically anorexia and bulimia, upon the body; and treatment options for anorexia and bulimia. Lyn described the groups reasoning behind selecting Barbie:

We wanted to have something fun and like media, like cultural related to it so that people would be able to relate to it more. Everyone knows Barbie, everyone has seen Barbie, everyone can kind of relate to like at one time playing with her. (I3.Lyn. 481-483)

**Organizing research.** After selecting their topic and sub-topic areas, the group then divided themselves up into pairs so that two group members took ownership over one of the three selected sub-topics. Sue and A.S4 focused on investigating Barbie’s anatomical body, Lyn and A.S3 focused on the impact of anorexia and bulimia, while A.S1 and A.S2 focused on treatment options.
When the group met for a second unfacilitated, in-class work period on February 25\textsuperscript{th}, they discussed the need for a clearer timeline with agreed-upon deadlines. By devising this timeline, the group planned to conduct research on their respective topics, meet to share the research they found, then work in pairs to put together one of three sections that was to comprise the presentation.

The group then met with FA for a second facilitated meeting on February 26\textsuperscript{th}, 2013. FA began the meeting by reviewing the students’ progress on various components of the project, including personal goals and peer evaluations. The students updated FA on their progress of selecting their topic and sub-topic areas. Since the students spoke of topic areas rather than expressing their idea in the form of a research question, FA offered guidance on devising a question around their choice. She encouraged them to devise a broad research question that could become more specific as their investigation continued, saying:

I know there was a lot of emphasis on having your question be specific or kind of – like in the [Introductory lecture] stuff and it’s just that… your question can be kind of broad as long as, it’s mostly in your presentation where you need to be kind of specific, right?

(FM2A, 204-210)

Based on FA’s suggestion, the students considered how they might articulate their topic in a form of a question that would incorporate the three sub-topics selected:

A.S2: “Could our question be as general as like ‘what would happen if Barbie went to the doctor?’ and then have all of the different…”

A.S4: “Yea that’s a good one – what would happen if Barbie went to the doctor?”

FA: “Yea, I mean it’s, yea, like I said as long as your question kind of encompasses everything you are going to talk about”. […]

A.S2: “What would the professionals say to Barbie?”
Lyn: “What would the doctors say to Barbie? What would the professionals say to Barbie?”

A.S2: “What would Barbie be diagnosed with? That kind of stuff”.

Lyn: “What is wrong with Barbie?”

Lyn finishes typing and looks between the group members.

S4: “That sounds like a pretty good basis. Because as long as we have an actual question to display in our presentation”. (FM2.A. 297-327)

Through this conversation, the group decided upon a general Inquiry Question of ‘What would happen if Barbie went to the doctor?’ The group agreed the question encompassed their three sub-topic areas well and agreed that the next step would be to begin researching the areas in pairs to expand their understandings and refine their question.

**Distributed collaborative work.** Since the group had already divided themselves up into pairs based on their three sub-topic areas, the students were organized to begin researching the respective areas as they related to the overall question. Therefore, in the days following the second facilitated meeting, each group member, either independently or with their partner, worked to identify sources of information that could be used to inform their investigation. During this time, Facebook was used as the main mode of communication. For example, on March 3rd A.S2 posted “Hey Lyn and Sue...I was wondering if A.S1 and I should focus on the treatment of the issues that you guys introduce or should we just approach it in general?” (FBO.A. 124-126). Others then responded to this post to engage in conversation. For example, A.S3 said, “Lyn and I could research the main health and anatomical problems associated with anorexia and you could probably make the treatment general (nutrition or therapy etc.)” (FBO.A. 127-129).

When the group came together for a third facilitated meeting, they spent their time sharing, comparing, and discussing the research they had found to-date. Each pair reported their
progress to the larger group. As pairs shared what they had found, other group members made suggestions as to how the research might progress further. For example:

Sue: “Yea, so we are looking at breast reduction surgery and other effects of fat tissue other than what people normally think, they’re more important and… possibly foot surgery…”

A.S4: “Foot extension surgery”.

Lyn: “Why does she normally have like crazy small feet?”

A.S4: “She has like size 3 feet and she’s like 6 feet tall”.

A.S2: “It would be interesting to compare that to…Um there was a book on foot binding”. (FM3.A. 733-741)

The students also took some time to compare progress made between the different subsections. For example, Lyn, A.S3, A.S2, and A.S1 compared their respective sections, making connections between the impact of anorexia or bulimia on the body and common treatment options.

**Presentation development.** During the third facilitated meeting, the group also discussed their ideas for creatively expressing and sharing their knowledge during their presentation. In support of the conversation, FA offered some guidance on grading and expectations, for example, expectations on presentation length, time-keeping, audience involvement, and technical requirements. To actively involve the audience and make the presentation exciting, the group planned to perform a skit where one student would act as Barbie and other students would act as Barbie’s doctors. The following is an excerpt from the observational notes taken during the meeting:

Lyn comments that it would be funny if A.S4 went ‘all out’ by dressing up in a dress and in pretending to be Barbie. Lyn imitates a ditzy “hi” to suggest that A.S4 act out Barbie’s character. (FM3.A. 284-286)
A.S4: “I’m going all out on makeup”, talking to Lyn she says, “you’re helping me”. They laugh.

Lyn says “It’s going to be so funny”. Lyn agrees that whatever visuals they can find and use the better the audience might appreciate those details.

A.S4: “I’m really pumped”. (FM3.A. 279-289)

In bringing the third facilitated meeting to an end, the group reviewed their timeline for project completion recognizing the need to produce their presentation materials and find a time to rehearse their presentation together. A.S1 volunteered to construct the multimedia for their presentation using Prezi. The group arranged a time to meet outside of regularly scheduled class and facilitated meeting times when they could rehearse their presentation.

Between the third and fourth facilitated meeting, student pairs completed their research and prepared their section of the presentation. The pairs then sent their material to A.S1 who began constructing a Prezi presentation. During their fourth facilitated meeting, the group reviewed the material to be included within each section of the presentation. In organizing and consolidating their presentation, the students coached one another to reduce and consolidate the material to fit within the 15-minute timeframe. As the group worked to consider what material they should keep or remove from the presentation, they took into consideration their three sub-sections and how the material presented within each sub-section would relate.

**Presentation rehearsal.** After their fourth facilitated meeting, Group A met for an unfacilitated rehearsal time. They met within the same room on campus in which they would be presenting so they could familiarize themselves with the space. This room was a medium sized lecture theatre, equipped with an overhead data projector and screen. To practice, the students connected a laptop to the overhead projector to project their completed Prezi presentation up on to the screen at the front of the room.
While students rehearsed the delivery of their content, they also developed a script for a skit where Barbie arrives at the doctor’s office and is consulted by her physicians. During the rehearsal, the students also coached one another on their presentation skills. For example, “As they rehearse, Sue faces A.S4 and as a result her back is turned to the audience. A.S3, ‘Remember that you are talking to the front here.’ A.S4, ‘Oh yea.’” (UFM1.A. 194-187).

**Presentation.** Two days later, the group presented in the same room in front of 12 other students from the anatomy course, FA, and Prof. At the time of the presentation, the group articulated their research question to be: What happens when Barbie goes to the doctor’s office? As the presentation ensued, each student shared the anatomical and topic-related knowledge they had gained through presentation and role-playing. The presentation began when Barbie entered the doctor’s office (Figure 5.1):

A.S4: “Hi, I’m Barbie”.

Sue: “Hello Barbie”.

A.S4: “Nice to meet you”.

Sue, “Have a seat”.

A.S4: “Oh, my back hurts so much”.

Sue: “So how do you feel today?”.

A.S4: “Well I came in today because I have been having a lot of problems with my body”. (Pres.A. 0:25-0:38)
After the doctor (Sue) informed Barbie of her anatomical abnormalities (including a disproportionate bust and waist circumference, unnatural torso and feet, etc.), the doctor referred Barbie to other specialists, “Well, now that we have discussed your anatomical problems I am going to bring in other specialists to help you” (Pres.A.5:28-5:32). These specialists (Lyn and A.S3) then shared with Barbie how she may be suffering from anorexia or bulimia and the impact of this on her anatomy. For example, Lyn said the following while displaying the image in Figure 5.2:

I am now going to talk about liver failure with you. Malnutrition can cause cirrhosis. This is when the liver develops enough scar tissue that it cannot function properly. […] Now this is a picture of what your liver looks like now [points to image of healthy liver] and this is a picture, that if you continue down the path you are going, what your liver could look like [points to image of a liver with cirrhosis]. This is all the dead liver tissue. I also pulled up an MRI of your abdomen. This is a cross section, and this is what your stomach looks like, and again if you continue down this path, this is what a degraded stomach would look like. (Pres.A. 7:00 – 7:36)
Figure 5.2. Group A’s liver failure slide.

Finally, a second set of specialists (A.S1 and A.S2) introduced themselves to Barbie and informed her of the treatment options available for anorexia and bulimia. Treatment options discussed included nutritional coaching, hospitalization, and counseling. The presentation ended with a question and answer period where audience members were given the opportunity to ask the group questions. When an audience member asked, Do you think it is possible for a human to have Barbie’s measurements?” (Pres.A. 15:20), multiple group members contributed to the answer. A.S2 (who had researched treatment options) explained, “There isn’t even room [in Barbie’s body] for any of the organs to be properly supported” (Pres.A. 16:00). Lyn (who had researched bulimia) added that, “People have done studies on [Barbie’s proportions] and people would be so malnourished that they wouldn’t be able to survive” (Pres.A. 16:32). While A.S4 (who had researched Barbie’s anatomical proportions) commented that, “In terms of measurements again, like Bridget Bardot was a model and she had a waist size about 18 inches. That’s what we are saying Barbie would have so it is possible to have a waist size that small but we are saying that the rest of the bodily proportions wouldn’t match up to that measurement”
(Pres.A. 16:55). Despite having conducted research on their respective areas, the students answered audience questions based on the integrated knowledge they had developed of the topic as a whole. Once the presentation was over, members of the group stood together as a group and packed up their bags. While they packed, they made plans to go out to dinner as a group before they each got too busy with final exams. In the days following the presentation, each member was expected to submit their completed peer evaluation rubrics and their final personal goal reflection to FA.

Overall, the group was successful with their presentation and project as a whole. FA was responsible for evaluating the group on the Group Process and Presentation components of the project. She gave the students a score of 21/25 on the Group Process component and a score of 23/25 on the Presentation component. In an interview conducted at the end of the term, FA commented on why she had graded Group A the way she had. In regards to the Group Process mark, FA commented that Group A had “started off very eager” (I.FA. 138), “they were really organized” (I.FA. 142), and that each member’s contribution over the course of the project had been “pretty equal” (I.FA. 354). In regards to the presentation mark, FA commented that the presentation was successful, however, she thought that the group could have done a better job at engaging the audience.

**Experiences during the Inquiry Process**

Lyn and Sue’s participation in the interview component of this study allowed them to reflect and comment on their experiences throughout their engagement with the project. In this section, the results of these individual experiences are presented.

**Lyn’s experiences.** Lyn was observed as she engaged in facilitated and unfacilitated work time. Further, she participated in a second interview held partway through the project on March 3rd, 2013. Based on analysis of such data, the following themes emerged of Lyn’s experience as she engaged with the project.
**Enthusiastic and motivated about a topic of interest.** Around the time that the group selected their topic, Lyn was becoming increasingly enthusiastic and motivated about the project: “I’m really motivated because I guess it’s something I’ve always been interested in” (I2.Lyn. 758-759). She had been the first to suggest that the group could link Barbie’s anatomy to disorders of anorexia and bulimia; and this suggestion came from an ongoing personal interest in the subject:

I’ve always been interested in kind of like eating disorders, anorexia, and bulimia. Like I remember learning about it in high school and just, I don’t know, being interested in it, just like, and I don’t really know what happens internally so for me I think it’s going to be cool to actually be able to do that research to find out. So instead of it just being like boring research that a prof is telling you to do, I actually get to do something that I want to do, which is good. (I2.Lyn. 111-116)

Lyn’s interests were related to understanding “what happens internally” (I2.Lyn. 113). She didn’t know “what’s going on celluarly inside” (12. Lyn, 114) when a body is suffering from anorexia or bulimia and was curious to find out. Further, Lyn saw connections between eating disorders and societal health issues being portrayed through media and culture:

That’s why I am excited because, I don’t know why I have always been interested in anorexia and bulimia um…. […] I just find, it’s just like so sad that media kind of, you know, instills that into young girls’ and boys’ minds, and I feel like there’s just so much talk about people either being like obese (I2.Lyn. 660-665).

Lyn had drawn upon her personal interests to shape the group’s direction and selection of the inquiry topic. Since the group had adopted Lyn’s ideas, she was highly enthusiastic and motivated to engage in the project and learn more.
Independent and collaborative work. In describing her experiences of working with her group, Lyn regularly highlighted how the group engaged in both independent and collaborative work. Different pairs had developed their own approach to working together:

We kind of all did our research on our own, I guess. I think the other two pairs [Sue and A.S4, A.S2 and A.S3] did their research sort of more together, but me and A.S3, we kind of basically… it just happened. He sent me his research before I did mine and […] he did all anorexia so I was like well I might as well do bulimia then, so then I just kind of did research […] We came up with points of our research in list form. (I3.Lyn. 32-39)

Since Lyn focused her research on bulimia and A.S3 on anorexia, the pair worked independently of one another, touching base only occasionally to compare their research. In contrast, the other two pairs – responsible for researching Barbie’s anatomical design and treatment options – often worked collaboratively, for example, meeting on campus regularly to work on their research efforts together.

Outstanding curiosity and further exploration. As the group developing and refining their presentation, it became clear to them that they had done more research than could be shared in the 15-minute presentation. As a result, they had to decide what they would and would not cover. Lyn had been particularly extensive with her research and she was encouraged by the others to consolidate and limit much of knowledge she had developed about eating disorders.

Overall, the Inquiry Project had served as an opportunity for Lyn to expand her understanding of eating disorders, however, she was left with an outstanding curiosities, particularly about mental health and media/cultural issues related to anorexia and bulimia. Given the constraints of the project, she found there was not enough time to research, explore, and share the full breadth of her interests:

I found 15 minutes was not enough for our group, we definitely could have done 20 minutes plus worth of information […] we really wanted to go into the media aspect of it
and that was two topics that we couldn’t cover and we really had to cut out stuff so…

um…. I feel like we could of done a little more. (I3.Lyn. 705-706, 723-725)

This outstanding curiosity was having an impact upon Lyn’s career interests. Whereas at the beginning of the project, Lyn expressed an interest in specific areas of health care – medicine, pharmaceuticals, and public health – she was now recognizing broader interests that would allow her to expand upon and continue her inquiry:

I know I definitely want to go into something obviously within the health care industry. It’s so open-ended, there is so much stuff to do I don’t even know what specifically I want to go into. […] I would kind of like to go more into the mental [aspect of eating disorders]. I guess maybe do further research on that - I think that would be cool because we just kind of did, I guess, what’s happening [internally to the body] but we didn’t really go into the mental aspect of it. (I3.Lyn. 518-520, 547-549)

Sue’s experiences. Like Lyn, Sue was observed alongside her peers during the facilitated and unfacilitated work periods. She participated in a second interview conducted partway through the project on March 1st, 2013. From analysis of these sources, three themes emerged of Sue’s experiences as she engaged with the project.

Doing what is supposed to be done for the group. At the outset of the project, Sue was intrigued and interested in the work ahead. However, as the group selected their topic of Barbie, Sue went from feeling “excited” to “average” (I2.Sue. 415, 416) because the topic was not of interest to her. She said, “[The topic is] not something that I’m interested in very much so…like that’s the group’s decision and I am ok with that” (I2.Sue. 415-417). Sue was working with a sense of obligation to her group – often referring to what was “supposed” to be done for the group. She commented, “I think next group meeting we were supposed to bring like our research together, which is a week from now” (I2.Sue. 32-33) and “I am supposed to meet with my partner sometime next week” (I2.Sue. 81).
More freedom in learning. Despite her lack of personal interest in the topic, Sue sensed that she and her group mates had more freedom to learn and explore their interests and associated knowledge in greater depth than the course curriculum allowed elsewhere (i.e., lecture and lab time):

[The Inquiry Project is] self-directed and it’s very free. You can explore on your own and do stuff that you are interested in, you’re not limited to course material and I think the focus is on the learning purpose and stuff, it will help us understand and learn better. (I2.Sue. 487-490)

The research in which they engaged extended beyond the material being covered in the Anatomy Course, “most of the research won’t overlap with the course and it will definitely provide more information that I didn’t know of”. (I2.Sue. 452)

Peer Evaluation Component

For the peer evaluation component of the project, the group was expected to design a rubric that each student would then use at the end of the project to evaluate one another. At the beginning of the project, Group A students worked together to design their peer evaluation rubric. While they had spent some time during the first in-class period working on the rubric together in person, they completed the work remotely of one another via a Google Docs page. The Google Docs page allowed each member to contribute to the collaboratively written document via the internet. The resulting rubric is displayed in Figure 5.2.
Table 5.2.

*Group A’s Peer Evaluation Rubric (P.E.A.1-41)*

<table>
<thead>
<tr>
<th>Category/Score</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication with Group Members</td>
<td>Always communicates with all group members during meetings and on the Facebook group. - Always responds to questions or concerns from all group members during meetings and on the Facebook group.</td>
<td>- Frequently communicates with all group members during meetings and on the Facebook group. - Frequently responds to questions or concerns from all group members during meetings and on the Facebook group.</td>
<td>- Sometimes communicates with most group members during meetings and on the Facebook group. - Sometimes responds to questions or concerns from most group members during meetings and on the Facebook group.</td>
<td>- Rarely communicates with few group members during meetings and on the Facebook group. - Rarely responds to questions or concerns from few group members during meetings and on the Facebook group.</td>
<td>- Never communicates with any group members during meetings and on the Facebook group.</td>
<td></td>
</tr>
<tr>
<td>Participation During Meetings</td>
<td>Consistently offers ideas. Listens to, respects, and encourages other group members during meetings. Works explay (sic) with his or her group to find solutions.</td>
<td>Frequently offers ideas. Listens to, and respects other group members during meetings. Works well with his or her group to find solutions.</td>
<td>Inconsistently offers ideas. Listens to, and respects other group members during meetings, most of the time. Works limitedly with his or her group to find solutions.</td>
<td>Rarely offers ideas. Listens to, and respects other group members with difficulty during meetings. Works minimally with his or her group to find solutions.</td>
<td>Avoids offering ideas, unless prompted. Reluctantly listens to, and respects other group members during meetings. Works seldomly (sic) with his or her group to find solutions.</td>
<td></td>
</tr>
<tr>
<td>Meeting Deadlines</td>
<td>- Always completes the assigned tasks before the deadline and can readily present them to the group at the meeting if required</td>
<td>- Almost always finishes the assigned tasks before the deadline and is ready to present them to the group at the meeting if required</td>
<td>- Finishes over half of the assigned tasks by the deadline and is somewhat ready to present them to the group at meetings if required</td>
<td>- Finishes only some of the assigned tasks and does not appear to be ready to present them to the group at the meetings</td>
<td>- Finishes none of the assigned tasks and cannot present anything to the group regarding their responsibilities during the meetings</td>
<td></td>
</tr>
<tr>
<td>Initiative</td>
<td>- consistently strives to communicate with other group members in times of uncertainty - helps other group members in need - an excellent leader</td>
<td>- frequently communicates with other group members in times of uncertainty - helps other group members in need - a suitable leader</td>
<td>- occasionally communicates with other group members in times of uncertainty - sometimes helps other group members in need - a satisfactory leader</td>
<td>- rarely communicates with other group members in times of uncertainty - sometimes helps other group members in need - shows only some leadership qualities</td>
<td>- shows no attempts and effort to contribute to the project - reluctant in helping other group members in need - unsuitable for a leadership role in the group</td>
<td></td>
</tr>
<tr>
<td>Approachability and Team Work Skills</td>
<td>Always respect different opinions from group members. Always communicates in a friendly manner with patience. Available for discussion outside of group meetings</td>
<td>Respect other's opinion most of the time Communicates in a friendly, patient manner most of the time. Available for discussion outside of group meetings.</td>
<td>Sometimes respect towards other's opinion Somewhat patient and friendly when communicating with group members Available for discussion outside of group meetings</td>
<td>Rarely respect other's opinion Show little patience and friendliness when communicating with group members Somewhat available for discussion outside of group meetings</td>
<td>Show no respect at all during group meetings. Communicate in an impatient, rude manner. Not available for discussion outside of group meetings</td>
<td></td>
</tr>
</tbody>
</table>
At the end of the project, each student used this rubric to evaluate each of the other group members. They then submitted their completed rubrics to FA who used the scores to calculate a peer evaluation mark for each group member by averaging the scores given to each person from his or her peers. Students rated each other very positively. Scores ranged from 23.8/25 to 25/25 with an overall average of 24.5/25. Students did not write qualitative comments on their group mates, however, the high quantitative scores granted to each student are suggestive of strong contributions and positive relationships between members.

**Personal Goals Component**

As previously described, each student was expected to set a personal goal for themselves at the outset of the Inquiry Project and devise an action plan for making progress on the goal over the length of the project. They were required to submit three reflections in an effort to describe their goal, provide evidence of their progress, and reflect on their experiences. Table 5.3 provides a summary of each student’s goal, their rationale for selecting it, and an example of the success they claimed across the term.
<table>
<thead>
<tr>
<th>Student</th>
<th>Goal</th>
<th>Rationale</th>
<th>Evidence of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.S1</td>
<td>Improve skill at reading and understanding research papers</td>
<td>I often spend too much time at finding and reading articles that may be related to my research topic, and this process is often inefficient as I am not particularly a fast reader, nor am I skilled in quickly understanding the main ideas in a research paper. (PG1.A.S1. 5-8)</td>
<td>I have become much more familiar with how to find the major concept and ideas from research articles. I think these are all signs of good progress, and that I have had quite some improvement in reading and understanding research papers (PG3.A.S1. 17-20)</td>
</tr>
<tr>
<td>A.S2</td>
<td>Develop note-taking habits and skills to improve study skills and test performance</td>
<td>After analyzing my academic habits, I came to realize that although I do complete all assigned readings, I never take notes on what I am reading and in the long run I am simply familiarizing myself with the topic as opposed to absorbing the information. (PG1.A.S2. 6-9)</td>
<td>I believe that I have taken away extremely valuable insights on different methods of note taking. I can genuinely say that I will continue to utilize the skills I have acquired from working towards my goal as I continue my student career and even in other areas of my life (PG3.A.S3. 29-34)</td>
</tr>
<tr>
<td>A.S3</td>
<td>Organizing raw research materials and information in a logical way for the project</td>
<td>The [Inquiry Project] provides students the opportunity to collaborate in a small group environment and present findings on a topic of interest related to anatomy. My personal goal for improvement relates to the research/ information gathering process for the presentation. (PG1.A.S3. 1-4)</td>
<td>By completing these components, I have successfully collaborated with the other members of my group and we are all well on track with the timeline in terms of the research component of the project. (PG2.A.S3. 19-25)</td>
</tr>
<tr>
<td>A.S4</td>
<td>Developing time management skills for balance between extra-curricular and academic responsibilities.</td>
<td>I am the kind of person who thrives on being busy. In addition to my schoolwork, I love being involved with extra-curricular activities and sports, as well as having time to explore my hobbies and spend time with friends. I absolutely love the Life Sciences program and all of my courses, but lately I have become too busy to keep up with schoolwork. (PG1.A.S4. 5-9)</td>
<td>Over the past few weeks I feel that I have done a great job of dedicating myself to my goal of making school my number one priority. (PG3.A.S4. 1-2) Overall, I believe I have made successful progress towards budgeting my time more appropriately, attending all academic sessions, and doing work ahead of time. (PG3.A.S4. 15-17)</td>
</tr>
<tr>
<td>Lyn</td>
<td>Improve vocabulary and reduce her use of “like”</td>
<td>I’m sure that throughout my lifetime I will have to make many presentations whether it is for work, school, or extracurricular involvement. […] By using the word “like” as a filler word it can come across as if you are unsure as to what you are talking about […] During my presentation I hope to speak slowly and eloquently using the proper vocabulary for my topic in order to get the points of our presentation across well to the audience. (PG1.A.Lyn. 43-56)</td>
<td>I do believe I need to continue working on my goal as it is going to be a lifelong battle trying to constantly improve my vocabulary and not use the word “like” as a filler word. (PG3.A.Lyn. 20-23) During the presentation, I believe I spoke with a strong and confident manner as well as not too fast as to put us under our allotted time. (PG3.A.Lyn. 45-47)</td>
</tr>
<tr>
<td>Sue</td>
<td>Develop more self-confidence when working in a team setting.</td>
<td>Although I have lived in Canada for many years, English is still my second language. The fear of not communicating as efficiently as others have caused my confident level is below normal while working in a team setting. (PG1.Sue. 5-7)</td>
<td>I find myself becoming more confident speaking and expressing within the group. In the last few meetings, I felt that I have known my group members more in depth and the embarrassment of speaking has almost disappeared (PG3.A.Sue. 6-9)</td>
</tr>
</tbody>
</table>

While each student’s goal was unique, students focused on similar aspects related to research skills, organizational skills, and interpersonal skills. All six appeared to draw on their experiences as students, their self-identified struggles, and skills related to the Inquiry Project. Further, students regularly recognized the impact their goal in context of the Inquiry Project, for example, A.S3 thought that the progress he had made on organizing research materials had facilitated him to collaborate with his group members and stay on track with timelines. Students also recognized their articulated goal and progress as having benefit beyond the parameters of the Inquiry Project and the Anatomy Course – either in application to other courses or future endeavors. For example, A.S2 thought she would continue to apply the note-taking skills she had developed to the remainder of her student career.

Since Lyn and Sue could elaborate on the personal goal component of the project through their participation in the interview component of this study, in depth perspective on their experiences of engaging in the personal goals component was possible. Therefore, Sue’s experience of the personal goals are presented next.

**Lyn’s personal goal.** Lyn was outgoing person with a bubbly personality. Despite this attitude, Lyn was concerned that she did not sound or look intelligent when she spoke with others, particularly those in “high power positions” (I3.Lyn. 648) such as her professors. She said, “when I speak I happen to not sound very intelligent (laughs) […] I say like and I talk with my hands a lot, I bobble my head” (I3.Lyn. 649-651). For the Personal Goal component of the Inquiry Project, Lyn wanted to improve the way she communicated with others by aiming to reduce her use of the word “like” from her everyday vocabulary. In her first reflection, Lyn wrote, “I have a
tendency to use the word “like” as a filler word to connect my thoughts when I am speaking too fast and do not have time to pause” (PG1.A.Lyn. 10-11). Lyn was inspired to select this goal during a conversation with her group mates where it was suggested that someone could set a personal goal to reduce the number of verbal ticks (like “um” or “ah”) said during public speaking engagements, such as the Inquiry Project final presentation. Lyn felt that a goal to reduce the use of the word “like” out of her vocabulary related to both the Inquiry Project and her life in general:

I believe that this goal is very relatable to the [Inquiry Project]. I’m sure that throughout my lifetime I will have to make many presentations whether it is for work, school, or extracurricular involvement. […] By using the word “like” as a filler word it can come across as if you are unsure as to what you are talking about when really (in the case of me) I just use it to take up time when I am talking too fast and thinking of the next phrase. During my presentation I hope to speak slowly and eloquently using the proper vocabulary for my topic in order to get the points of our presentation across well to the audience. (PG1.Lyn, 43-54)

Lyn applied a variety of strategies for becoming more conscious of her verbal tick and improving her vocabulary. For example, she used an online dictionary and their word of the day feature to challenge herself at using new words in regular conversation each day. Toward the end of the project, Lyn sought feedback on her progress from family and peers. By the end of the project, Lyn reported improvements to her vocabulary, however admitted that it would be an ongoing effort: “I do believe I need to continue working on my goal as it is going to be a lifelong battle trying to constantly improve my vocabulary and not use the word ‘like’ as a filler word” (PG3.A.Lyn. 11-14).

Overall, Lyn’s goal was related to the way she expressed herself during both academic and personal activities. She understood the goal would have impact on the Inquiry presentation,
on her interactions with friends, family members, and professors, and on her future endeavors such as future presentations and career activities. Returning to her original inspiration for focusing on the goal, Lyn commented “I have gotten a little more comfortable in front of pros because of this Inquiry Project, which is good” (I3.Lyn. 222-223).

**Sue’s personal goal.** In her first personal goal reflection, Sue wrote, “Although I have lived in Canada for many years, English is still my second language. The fear of not communicating as efficiently as others have caused my confident level is below normal while working in a team setting” (PG1.Sue. 5-7). Sue had a quiet demeanor, and in the first facilitated meeting, Sue spoke infrequently; she listened attentively but others dominate the conversation. For her personal goal, Sue aimed to record her participation and reflect on her interaction by comparing her participation against that of her group mates. Upon reflection, Sue would rate herself on how active of a participant she had been in comparison to a self-rated average (Figure 5.3).

<table>
<thead>
<tr>
<th>Data (in chronological order)</th>
<th>Participation</th>
<th>Self-rated activeness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st facilitated meeting</td>
<td>- Introduction and ice breaker</td>
<td>Below average</td>
</tr>
<tr>
<td></td>
<td>- suggested a research topic: The limits of human body and their representation in cartoons and animations</td>
<td></td>
</tr>
<tr>
<td>Online interaction</td>
<td>- Voted on topic interested</td>
<td>Average</td>
</tr>
<tr>
<td>1st private group meeting</td>
<td>- Participated on deciding the topic: Barbie- How would she work in real life.</td>
<td>Below average</td>
</tr>
<tr>
<td></td>
<td>- Participated in peer evaluation rubric by suggesting an evaluation category: Approachability and teamwork skills</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 5.3. Sue’s personal goal. Sue collected data on her participation in group activities. (PG2.Sue)*

As the project continued, Sue’s confidence in speaking and participating within the group grew. In her second personal goal reflection, Sue wrote, “I have found out that I am more
confident speaking in a small group setting as I am ‘above average’ in the private meetings with my partner” (PG2.Sue. 7-8). She became more outgoing and engaged when she was working one-on-one with her partner (A.S4): she talked more frequently, shared her opinion, and made jokes. Toward the end of the project, Sue’s confidence began to extend beyond her engagement with A.S4 to include the larger group of six. By the end of the project Sue reflected on her progress to say:

My personal goal was like to feel more confident in speaking in groups, as you might of noticed I am kind of quiet in the first few facilitated meetings but um… as time [went on], I’m familiar with my group members and more confident speaking in the group.

(I3.Sue. 351-356)

Overall, Sue’s goal was related to her engagement in the Inquiry Project and her participation in Group A. However, it also helped her develop a sense of confidence that, she felt, would continue to positively impact the way she engaged with others in future group settings.

Overall Experiences and Reflections after Inquiry

After the Inquiry Project was complete, I met with Lyn and Sue individually for one final interview. During these interviews, the students reflected on their experiences of the Inquiry Project as a whole, once their engagement in the project was complete. In addition to student interviews, an interview was conducted with FC to collect her reflections on her experiences and observations as a facilitator. Analysis of these interviews revealed some overall themes of such experiences and are presented in the remainder of this section.

Lyn’s experiences. The interview with Lyn was conducted on April 8th, 2013. Two major themes of Lyn’s overall experiences emerged from analysis of the transcript.

Exploring and sharing interests through applying anatomy. Upon completing the Inquiry Project and its final presentation, Lyn felt the project had allowed her and her group members to explore their interests through the application of anatomy knowledge. Further, the
presentation had been a chance to creatively share their interests and discoveries with others. Through the project, Lyn had developed enough anatomy knowledge that she could now research and understand her interests at a greater level of depth:

Now that I can understand different anatomical things and what does go on inside your body, it was cool researching it and understanding it opposed to if I would have done [the research] back in high school or in elementary school, I wouldn’t have understood what any of that stuff meant. So, yea it was interesting. (I3.Lyn. 510-514)

She recognized that her university-level understanding of anatomy could be applied through research to better understand the internal workings of the human body. As a result, the Inquiry Project came to serve as an opportunity to express opinions about anatomy and science in a new way:

I feel like [the project] gave us a whole new set of skills that we wouldn’t have naturally learnt in anatomy, because in anatomy - well in all of our courses – we are just tested. There’s no speaking aspect. We are not supposed to have opinions; it’s all just science. So [the Inquiry Project] is sort of our way to get our voice out there on topics that we think are really interesting. (I3.Lyn. 776-770)

The experience of having and sharing opinions about science was contradictory to her previously held notions of the discipline – of science as external facts to be memorized and tested. With her group, Lyn had drawn upon her personal interests and the connections between interests and society to serve as inspiration for making the presentation interesting for and relatable to the audience.

**Inquiry as a positive social experience.** Overall, the Inquiry Project was as a positive experience due, in large part, to the way Lyn got to talk and get to know her group members better. The overall purpose of doing the Inquiry Project, “to me it was honestly like a great way to kind of talk to more people in the program than I normally wouldn’t have” (I3.Lyn 561-562). Due
to the way in which the project randomly placed students together in groups, Lyn got to know classmates who she admittedly might not have talked to otherwise. Through getting to know others in this way, Lyn felt a greater sense of community within her program:

> It kind of made me feel that I am not alone. I always thought [that my group mates] were really studious in. They normally sit in the front and here I am in the back, and I was like ‘oh maybe it’s just me that finds Life Science so hard’ but talking to other people, I realized like they are even struggling just to get through too, so its not just me, it’s all of us. So it kind of made it seem more like togetherness. It kind of made it feel like a smaller program compared to before it felt so huge but when we get to know more people it’s like ‘oh everyone is going through the same thing’. (I3.Lyn. 575-583)

Lyn developed positive social relationships with others through the project. She regularly talked with her peers about life beyond the project. For example, she regularly initiated conversation about campus clubs and events. After the final presentation was complete, Lyn suggested to the others that the group go out for dinner.

**Sue’s experiences.** The interview with Sue was conducted on April 9th, 2013. One major theme emerged from analysis of the transcript.

**Meaning and friendships.** The Inquiry Project was a chance to be creative, follow student-based interests, and learn something beyond the regular course content. The topic – Barbie and eating disorders – had been interesting and exciting to research, but it lacked meaning for Sue on a more personal level. For example, we had the following conversation, “Lauren: Um, how meaningful would you say this project was to you? Sue: As in the topic’s content? Lauren: Yea. Sue: Not really, but it was interesting” (I3.Sue. 338-344).

Finding the inquiry topic interesting but not particularly meaningful, the project was meaningful to Sue in other ways: the way in which she made progress on her personal goal, and the way in which she had made friends with her group mates. The personal goal had allowed Sue
to feel “more confident and less embarrassed speaking in a group setting” (I3.Sue. 368). She recognized how this confidence would help her engage with others into the future. Sue also made new friends within the group, establishing relationships that she thought would continue into the following academic year. For these reasons, Sue felt the Inquiry Project had been a meaningful and worthwhile activity.

**FA’s experiences.** FA was interviewed on April 4th, 2013. Three major themes arose of FA’s role, experiences, and observations through analysis of the interview transcript.

**A “glorified babysitter”, advisor, and observer.** FA described her facilitator role as “kind of a glorified babysitter” (I.FA. 68) who worked to keep the group on track. She articulated her role to students in the first facilitated meeting by saying that:

> My role is just to make sure you guys are on the right track, that you are not confused and you know what to expect. So I am mostly like on the logistic side – like when grading stuff is due. I’m not here to like be your Google or answer anatomical questions and stuff like that. That’s all for you guys and your inquiry-based learning. (FM1.A. 71-74)

FA served a dominant role in the first facilitated meeting when she outlined and explained the various components of the project to the group. In reflecting on the first facilitated meeting, FA said, “I know in lecture the project wasn’t really explained very well so the first [facilitated] meeting was kind of going through that and explaining what the project actually was and what was expected of them” (I.FA. 71-73). After the first facilitated meeting, however, FA’s saw the role was “basically just [making] sure they were on track with where they should be at that time in the project” (I.FA. 78-79), and so, as the project progressed, FA’s role was regularly limited to procedural details such as due dates, meeting times, and room bookings.

As part of FA’s duties as a facilitator she was also responsible for collecting and evaluating students’ personal goal submissions and the final presentation. In serving this role, FA was an observer of the group’s activities. During facilitated meetings, FA was rarely involved in
the conversations. She would sit and watch the students as they talked with one another, recording notes on their engagement and participation. FA said of her observations:

There were definitely two [students] that were quieter for sure, Sue and A.S1. […] A.S3 started off quiet and then kind of built into it and by the end he was a lot more involved. I would say A.S2 took a lot of control but in a…. not in an aggressive way [laughs] whereas sometimes Lyn got a little bit aggressive. (I.FA. 331-335)

FA would watch the students diligently and took an interest in how their engagement might be developing over time. For example, when she first noticed that Sue and A.S1 were quieter she felt “a little bit uneasy about some of their contributions” (I.FA. 355). However, she continued to observe the students closely in an effort to appreciate the ways in which they might be contributing. For example, she reflected:

I remember listening on Sue and A.S4’s conversation with that and um, within the whole group meeting A.S4 definitely did way more talking than Sue but within that, within just the two of them Sue seemed a lot more comfortable and was talking a lot more and seemed to have done a lot of research and have a lot of good ideas. (I.FA. 355-369)

*Noticing changes over time.* As the facilitator, FA’s role was to evaluate the group’s progress over time. As such, FA was attuned to the way in which students had changed over the course of the project. She noted changes with regards to students’ feelings of confusion as well as their skills and attitudes.

FA recognized the project was a new and different learning experience for many of the students, “I would say 90% of the students in that course are in Life Science and haven’t done a group project before” (I.FA. 398-399). As a new experience, FA observed how confusion had been a common sentiment among the students as they started into the project: “I think at the very beginning a lot of people were just really confused of what was expected of them” (I.FA. 200-201). However, the students gained clarity on the project, particularly after the first and second
facilitated meetings: “I think that [the confusion] gets cleared up. I would like to say after the first facilitated meeting, but it probably took actually until the second just for people to kind of figure out what they wanted to do and stuff” (I.FA. 412-414).

Another change that FA noticed was in the way in which students developed skills, becoming more adaptable and open-minded by engaging in the project. She thought the project had helped students become “a bit more open minded and kind of more flexible with ideas” (I.FA. 466-467). The project seemed to benefit most students, but FA believed it had been of greatest value to the quiet and shy students who had demonstrated improved confidence over time:

I think it would be of most value to the students that started out quieter and then kind of gained confidence through the presentation or through the project. Um, I mean to the students that were kind of natural leaders and started out more outgoing and stuff, it probably didn’t have a huge effect, but I would say any circumstance working in a group is good. (I.FA. 455-459)

In offering an example of this kind of change, FA referred to Sue and the way in which she had developed confidence in working with her group mates as the project progressed. Overall, FA’s observations of the group’s progress were predominated her experience as a facilitator. Her observations highlight the ways in which the group and its students were positively influenced by the project.

**Comparing group A to other groups.** While FA had been a facilitator to Group A, she had also served as a facilitator for two other groups who were not part of the research study. Her insights of the ways in which Group A was similar or different from these other groups was helpful in further characterizing Group A and the students’ experiences of Inquiry. FA found Group A to be more eager, enthusiastic, and driven during facilitated meetings than her two other groups. An example of this was the way in which “they came to the first meeting with ideas of
what they wanted their topic to be, um, which was different from all my other groups” (I.FA. 138-140).

Given their enthusiasm, FA anticipated Group A’s presentation would stand out in comparison to the other groups. However, she was surprised when their presentation wasn’t as enthusiastic or engaging as she had predicted:

[Their presentation] wasn’t as exciting as I thought it was going to be. Like during the meetings they were all really enthusiastic about stuff whereas in the presentation, I mean they kind of read off the slides and talked more to themselves more than I was expecting. […] They were all pretty outgoing so I was kind of expecting them to be the group… or a group that, you know, was more audience interactive but I felt like they kind of talked within themselves a bit more than I was expecting, which was surprising. (I.FA. 147-154)

Overall, FA’s unique perspective as a facilitator for both Group A as well as two other groups offers an opportunity to compare and contrast between research participants and other students in the Anatomy Course. While FA perceived Group A to be more eager, enthusiastic, and driven than other groups, their eagerness did not appear to have significant impact on the resulting presentation performance at the end of the project.

**Chapter Summary**

This chapter has focused upon Group A - the inquiry process and students’ experiences of engagement. Overall, Group A completed the Inquiry Project successfully. The group selected a topic – Barbie’s body – early on during the first facilitated meeting and structured their work around the three sub-topics. Around this, the group articulated a research question of: What would happen if Barbie went to the doctor? They divided the work up into pairs. Within this division of labour, group members worked individually, together with a partner, and collaboratively with the larger group. Each pair was responsible for researching and developing on the three sub-sections of their presentation related to their topic of focus. They constructed a
Prezi presentation and skit where Barbie visited her doctor. After continued editing and rehearsal, the group presented to an audience of other anatomy students, their facilitator, and Prof addressing their question.

FA, who served as the group’s facilitator, considered her role to be that of an advisor keeping the group on track with regards to scheduling and timing. She observed how the group worked together and contributed in different but equally engaging ways. As a result of their engagement in the project, FA thought students gained confidence and group work skills, particularly those students who were quieter such as Sue.

Two students from Group A – Lyn and Sue – participated in the interview component of this study to share their experiences as students of the project. At the outset of the Inquiry Project, Lyn had sensed that the project would be an opportunity to creatively explore anatomy and develop teamwork skills. Sue thought that it would be an opportunity for students to teach one another. Lyn developed a strong enthusiasm for the selected topic, which spurred her motivation to research and learn more. Sue, on the other hand, did not find the topic of interest and described decreased motivation. Despite this, Sue appreciated the freedom granted to the group to be self-directed and explore learning based on interests. Both students engaged in a combination of independent and collaborative work, and both students felt they had developed positive relationships with their peers. Overall, the project had served as a positive social experience for Lyn allowing her to feel a greater sense of community and camaraderie with her peers. Sue developed self-confidence in working with others, both through her personal goal as well as through her positive interactions with the group. Overall, it was through this accomplishment as well as through the friendships she made with group mates that Sue found the project to be meaningful and valuable.

The next chapter, Chapter 6, follows a similar structure to that of this current chapter, in that Group B’s process for inquiry engagement, the personal goals and peer evaluation
components are presented. Vignettes from Group B participants highlight students’ experiences of engagement throughout.
Chapter 6

Group B

This chapter focuses on Group B – how the students engaged in their group work and made progress on the project, as well as the experiences of group members throughout their engagement. To review, Group B consisted of six students including two men (B.S1 and B.S2) and four women (B.S3, B.S4, Heather, and Sam). Five of the six students were in their second year of a Life Sciences program, while one student (B.S3) was a third year Biochemistry student. Group B’s facilitator, FB, was a third year Life Sciences student who had taken the Anatomy Course as a student the previous year. This was FB’s first time serving as a facilitator. Study participants Heather and Sam were interviewed throughout the term. Additionally, FB was interviewed at the end of the term.

Table 1 summarizes Group B’s engagement in the project. Their actions are organized into three categories: (1) the inquiry process itself – progress on the inquiry topic, question, research, and presentation; (2) the personal goals component of the project; and (3) the peer evaluation component of the project. The Inquiry Process is further organized into six stages reflective of the steps the group took: getting started, idea formation, initial research and question formation, presentation development and in-depth research, presentation rehearsal, and finally, the presentation itself. These stages were author-derived based upon observation and data analysis of the activities and actions Group C engaged in throughout the project.

This chapter is organized based on the categories and stages outlined above. First, the group’s inquiry process and stages engaged are presented. Following this, the personal goal and peer evaluation components are discussed. Throughout these sections, vignettes of Heather, Sam, and FB’s experiences are offered to illustrate these individuals’ lived experiences of the project. Finally, the chapter concludes with a consideration of Heather, Sam, and FB’s reflections of the project once it was complete.
Table 6.1.

*Timeline of Group B’s Progress*

<table>
<thead>
<tr>
<th>Dates</th>
<th>Meetings</th>
<th>Inquiry Process</th>
<th>Personal Goals</th>
<th>Peer Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 30</td>
<td>Facilitated Meeting #1</td>
<td><em>Getting Started</em></td>
<td>• Instructions from FB on expectations</td>
<td>• Instructions from FB on expectations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clarified roles, goals, and expectations for the</td>
<td></td>
<td>• Formulated ideas regarding peer evaluations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>project</td>
<td></td>
<td>• Discusses components of rubric</td>
</tr>
<tr>
<td>Feb. 6</td>
<td>Facilitated Meeting #2</td>
<td><em>Idea Formation</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shared individual interests for topic</td>
<td></td>
<td>• Group authorship of rubric</td>
</tr>
<tr>
<td>Feb. 11</td>
<td>In-Class Period #1</td>
<td><em>Initial Research and Question Formation</em></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Began initial research on potential topics</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Selected an inquiry topic and continued with initial research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb. 20</td>
<td>Unfacilitated Facebook</td>
<td><em>Presentation Development and In-depth Research</em></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Meeting</td>
<td>• Developed presentation outline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb. 25</td>
<td>In-Class Period #2</td>
<td></td>
<td>• FB hands back personal goal reflections with feedback</td>
<td></td>
</tr>
<tr>
<td>Mar. 6</td>
<td>Facilitated Meeting #3</td>
<td></td>
<td>• Continued development of presentation outline</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Divided research responsibilities into individual components based on outline</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>• Brainstormed creative aspects of presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar. 13</td>
<td>Unfacilitated Meeting</td>
<td></td>
<td>• Shared research performed independently</td>
<td></td>
</tr>
<tr>
<td>Mar. 25</td>
<td>In-Class Period #3</td>
<td></td>
<td>• Discussed creative aspects of presentation</td>
<td></td>
</tr>
<tr>
<td>Mar. 27</td>
<td>Facilitated Meeting #4</td>
<td></td>
<td>• Authored creative content (music video lyrics and script for video story)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Recorded and edited videos for presentation</td>
<td></td>
</tr>
<tr>
<td>Apr. 3</td>
<td>Presentation</td>
<td><em>Presentation Rehearsal</em></td>
<td>• Submitted second personal goal reflection to FB</td>
<td></td>
</tr>
<tr>
<td>Apr. 5</td>
<td></td>
<td>• Rehearsed presentation</td>
<td></td>
<td>• Completed peer evaluation using rubric and submitted to FB</td>
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<tr>
<td></td>
<td></td>
<td>• Continued rehearsal</td>
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<td></td>
<td></td>
<td></td>
<td>• Submitted third and final personal goal reflection to FB</td>
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<tr>
<td></td>
<td></td>
<td>• Gave presentation</td>
<td></td>
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</table>
The Inquiry Process

Getting started. To start the group project, FB contacted Group B by email to arrange the first facilitated meeting for January 30th and the group met in a group meeting room located within a campus library. At the outset of the first facilitated meeting, FB asked each student to introduce him or herself and share what they hoped to learn from the project. For example, B.S1 said, “I’m B.S1, second year SSP Life Sciences and some things that I would like to expand my knowledge on or learn: definitely to continue getting better at time management – that’s definitely something for me – and then obviously just like communication skills” (FM1.B. 84-87).

After introductions, FB verbally assessed how much students understood of the different evaluation components of the Inquiry Project and spent some time explaining and clarifying the personal goals, peer evaluation, group process, and presentation components of their grade. Students asked questions of FB regarding the personal goal component, clarifying when the first reflection was due. FB finished the meeting by explaining that, in the next meeting, they would spend some time discussing ideas for their inquiry topic and in preparation for the meeting encouraged students to give some thought to ideas that were of interest them.

Idea formation. Group B’s second facilitated meeting was held one week after the first on February 6th. FB started the meeting by explaining:

The purpose of this meeting is a brainstorming session for your group to think about potential questions and ideas for the project and also the second thing is to discuss over potential peer evaluation criteria for the peer evaluation form. So which one would you guys like to start with? (FM2.B. 58-61)

The group agreed they would like to start with brainstorming their inquiry topic and they took turns sharing the ideas they had individually developed over the past week. Heather was the first to share and explained:
One of the things that I’m interested in is the link between anatomy and thought – like consciousness. I was thinking last night, I was just looking up some stuff and I ran into an article about the placebo effect or the nocebo effect. (FM2.B. 74-77)

She then read from the article she had found, telling the group a story of a man who was diagnosed with liver cancer and died within three months. Upon autopsy it was revealed that the man was physiologically healthy – there had been a mix up in the patient’s files. With this story, the group appeared intrigued and discussion continued:

B.S3: “So what did he die from? Was it like similar to liver cancer?”

Many students in the group speak up at once. They seem to be curious what would have caused this man to die if he didn’t have liver cancer. They share various hypotheses all at once.

“Yea exactly”,

“Mimic the symptoms of…”,

“It could have been side effects of the drug.” (FM2.B. 111-118)

With FB’s encouragement, each member of the group went on to share their individual ideas for the project. B.S1 was interested in concussions and the impact on attention span. B.S4 shared that she was interested in conjoined twins and how their anatomy works. B.S3 was interested in mental disorders such as schizophrenia and possible anatomical explanations. Finally, B.S3 shared that she was interested in stress fractures in bones caused by repeated exercise. After each student shared, the group would spend a few minutes conversing about the topic - sharing what they each knew, posing additional questions, and expressing their interest or curiosity.

Once everyone had shared, FB then probed the students: “So out of these ideas do you guys have a preferred one? Do you guys want to talk it over?” (FM2.B. 337-338). At this point the conversation quickly returned to two of the initial ideas posed: Heather’s idea around the
brain and the placebo effect and B.S4’s idea around conjoined twins. The group agreed that their selection would depend upon how easily research could be found on the topic, and so, some students spent the remainder of their meeting time searching the Internet for literature on the two topics. Other students created a Google Documents page where the group could begin recording and sharing the research they had found. The group set a goal to complete further research on the two topic ideas before making a decision.

**Initial research and question formation.** A whole month passed before the group met with FB for a facilitated meeting. In between this time, the group continued to progress on their own through two avenues. First, they met during the first in-class unfacilitated work period on February 7th, 2013 and worked to complete their peer evaluation rubric, which was then submitted to FB through email. In and around this time, the group also selected their topic, choosing to focus on the placebo effect.

Second, on February 20th, the group arranged to meet on Facebook for a synchronous online chat to discuss the research that each member had collected on the topic to date. The students selected the online chat approach because it was Reading Week and the break meant that many of the students were away from campus and unable to meet in person. Leading up to this meeting, students had been doing initial research on the placebo effect independently of one another. During the meeting, students took turns sharing what they had each learned through their initial research. The focus of each student’s investigation appeared to have been driven by his or her own interests. For example:

B.S1: “I found that I tended to go into more of the nocebo stream myself. I found that the main hormone for pain perception is the hormone CCK, specifically CCK-4 and CCK-8. basically it just leads through a pathway similar to what S3 was mentioning”. (FBO.B. 352-354)
B.S3: “I found a very interesting study on CCK blocking and the nocebo effect. […] I was also looking more in depth into the study on the functional neuroanatomy of the placebo effect, and found that there may be certain areas of the brain that, if they have increased gray matter, make patients more susceptible to experiencing the placebo effect”. (FBO.B. 394-402)

After each person had shared his or her work to date, the group discussed commonalities between their findings. For example, they drew connections between brain anatomy and the physiology of the placebo effect. Finally, the group discussed how they could phrase a research question that was related to the topic area they had chosen, deciding on: "How can the power of suggestion be used by medical professionals to enhance or detract from the efficacy of treatment for certain conditions?" (FBO.B. 492-494).

**Presentation development and in-depth research.** Across their second facilitated meeting (February 25th, 2013) and their third facilitated meeting (March 6th, 2013), the group spent time discussing an outline for their presentation based on their Inquiry Question. They considered how they would organize their presentation and how this structure would help them to organize the remaining research work ahead. For example:

B.S3: “I was thinking about a potential layout for the presentation lately…um and sort of how we could break it down into like how much time to spend on each different [topics] and I was wondering if we could even divide it into sections of the presentation and then that way we can be also sort of figuring out, ‘ok what would we be wanting to actually present from this?’” (FM3.B. 180-184)

Sam: “So I think our next step would be to stem off the whole outline topic thing and then assign everyone a topic kind of to research more into so we each have like a good section or chunk done. Then we should probably have a meeting where we can all present
each of our findings and after that […] we can start coming up with our presentation…
like fleshing out the presentation”. (FM3.B. 479-485)

In their third facilitated meeting, the group also brainstormed ideas for creatively presenting their project. This conversation was facilitated by FB who posed the question: “What are your ideas for the presentation? How do you guys want to organize your information and present it to the class?” (FM3.B. 267-268). The group explained to FB that they were planning to prepare “a video reenactment” (FM3.B. 283) to tell “the story that first hooked everyone to start researching this topic” (FM3.B. 268). The story the group was referring to was the case example of the man who had been falsely diagnosed with liver cancer – believing in the diagnosis so strongly that he had died despite his physical health.

Group members agreed that the video would be an effective way to highlight a case example and break up the factual information being conveyed. For example, B.S1 said:

At each stage like, we can like explain the story at the start, do the video, do the little presentation […] we can be like ‘so what was happening with his body at this point?’ and then through that present all the information. […] Then it is just more interactive instead of us just going up there and basically being like a lecture. (FM3.B. 547-557)

As a result of their efforts throughout the third facilitated meeting, the group recorded a presentation outline in their shared Google Documents page (Figure 6.1).

| • 2-3 minutes - Introductory video (placebo experiment? mystery of the liver cancer case?) |
| • 3 minutes - What is the placebo effect? Current background knowledge. Brief history of its discovery, use. (B.S2 and Heather) |
| • 7 minutes - Current anatomical understanding. CCK? Dopamine? How does anatomy play a role in this effect, and how does the effect influence anatomy? (B.S1, B.S4, B.S3) |
| • 3 minutes - Clinical application. Are we using placebo to our fullest potential? How could this formerly "nuisance" effect actually be used AS a treatment? Where does "ethical" become unhelpful? Is our obligation to inform of potential side effects actually CAUSING those side effects? (Sam) |

Figure 6.1. Group B’s presentation outline (GD.B. 363-372)
After the group had devised their presentation outline, each student selected an area of focus to conduct further research based upon their assigned section. When the group got together for an unfacilitated meeting on March 13th, they shared the knowledge they had developed through their independent investigations and further coordinated the sections based on the research. In a later interview, Heather described the approach the group took during this time:

We all laid out our presentation, like where we wanted to go with it and we all picked like our two minute slot of what we wanted to talk about and like really kind of drew from the research that we all had done to fill that two minutes, I guess of like what we each wanted to present so it was more individual I guess and then we tried to put it all together at the end. (I3.Heather. 34-39)

During the meeting, the group once again discussed their ideas for a creative video. The group decided to film and incorporate two specific videos into their presentation, the first being a music video that would be used to introduce the topic of placebo and nocebo at the beginning of the presentation; the second being a case study story that would be incorporated throughout their presentation to illustrate the effects of placebo and nocebo on a patient.

During their third in-class work period on March 25th, the group worked on a script for their two videos and later met on campus to act out their script and film the video. In a later interview, Sam summarized the group’s work during this time: “we all sat together and tried to come up with lyrics and we like memorized it within the day and just filmed during the night” (I4.Sam. 359-360). In composing their lyrics, the group was inspired by the theme song to a popular sitcom, the Big Bang Theory, changing the lyrics to match their Inquiry Question and topic. They filmed the video on campus in an empty lecture theatre, using a variety of props such as their lab coats, textbooks, and laboratory goggles. Sam then edited both videos using a video editing program on her laptop.
**Presentation rehearsal.** At the beginning of the fourth facilitated meeting, the group reported their progress to FB. FB asked, “I am wondering if you feel comfortable to do a dry run through your presentation right now” (FM4.B. 94-95). The remainder of the facilitated meeting was spent rehearsing the presentation. Through rehearsal, students coordinated their sections with one another, for example:

B.S4 wonders if she should say the last part of her prepared script: “when the drug was proven to be ineffective and the patient’s hopes were dashed, a nocebo effect occurred”.

Sam: “Oh, we changed that part [in the video story]”.

S4: “Oh ok, I guess I will just take that part out then”. (FM4.B. 248-253)

**Presentation.** The group presented on April 3rd to a room filled with 12 other students from the course, FB, and Prof. At the time of the presentation, the group’s articulated Inquiry Question was: How does the power of suggestion relate to Neuroanatomy and Neurochemistry? What clinical implications does this have? The presentation began with their music video (Figure 6.2), which was comprised of the following lyrics set to the tune of the *Big Bang Theory* jingle:

My whole body lying in a sickly state

With over 14 billion drugs we’ve tried, what should I do?! WAIT!

The doc gave me a pill, now I’m no longer feelin’ ill,

don’t know if it was just my will

I think I’m cured! The placebo effect!

Brain, science, dopamine, unraveling anatomy

That all started with a sugar pill! Hooray!

(FBO.B. 888-894)
Following the music video, each student performed his or her section of the presentation. Each section explained the placebo and nocebo effect and the related anatomy. For example, B.S3 said the following while displaying the image in Figure 6.3:

So if our doctor prescribes this so-called “drug” for liver cancer, what is going on in her brain? How real are the effects she may experience? Let’s take a look! Scientists investigating the power of suggestion have made some interesting findings when looking at the brain neuroanatomy. Even a harmless event if patients expect pain, has led to response by areas like the anterior cingulate cortex, parietal operculum, and posterior insula – which are all related to pain. So if our patient hears her drug could cause negative side effects, she’s more likely to experience those effects than if she hadn’t been told. […] In patients expecting relief from depression, it’s been shown that areas in red, such as the prefrontal cortex, increase their metabolism of glucose, while areas like the
parahippocampus, in yellow, show decreased metabolism. Metabolic changes depend on the expected effect. (Pres.B. 5:35-6:57)

Figure 6.3. Example of slide from Group B’s presentation. B.S3’s section.

In between each student’s section, the group’s presentation included their video case example. The case example consisted of four scenes (Figure 6.4).
Figure 6.4. Scenes from Group B’s case example.

In the first scene, a patient (B.S3) arrives at a doctor’s office (B.S2) with symptoms of abdominal pain, weakness, and weight loss. The doctor orders some tests and reports to the patient that they have liver cancer. In the second scene, the doctor is shown researching his patient’s condition and learning that there is no drug for the disease. The doctor considers the use of a placebo. In the third scene, the doctor prescribes the placebo drug to his patient and explains potential side effects. In the fourth and final scene, the patient returns explaining that she had experienced some of the side effects of the drug but otherwise feels better. The doctor then receives the latest test results and tells the patient that they have been cured. As the students presented they related their message to the case example being demonstrated through the video. For example, B.S4 said the following while displaying the image in Figure 6.5:

To relate this theory back to our patient’s case, we need to consider other functions of dopamine in the body. Dopamine has been related to sympathetic stimulation of the
lymphatic system, and many lymphocytes have dopaminergic receptors. A recent study has also shown that dopamine can stop the appearance of new blood vessels in cancerous tumours, impeding their growth. These two effects combined, along with the patient’s belief in her recovery, could explain why a placebo would be effective in this case. It is possible that the excess dopamine released in the brain would slow down the disease’s progression, while stimulation of the lymphocytes allows them to attack and kill the cancerous cells. (PresB. 7:12-7:20)

Figure 6.5. Example of slide from Group B’s presentation. B.S4’s section.

At the end of the presentation, the audience posed questions to the group and the students responded. For example, FB asked the group “Do you guys think the placebo effect could also occur in animal models, such as mice or rats?” (Pres.B. 19:04-19:06). Numerous students shared their input in response. B.S1 (who had focused his research on investigating current anatomical and chemical explanations for the placebo effect) responded to say, “There is definitely evidence of mice and stuff. I definitely came across it but can’t remember the specifics because I focused
mainly on humans, but there was defiantly research on mice using the placebo effects.” (Pres.B. 19:06-19:30). Following this, B.S2 (who had focused his research on investigating general information and history of placebo use) said:

Um from one article I talked about with irritable bowel syndrome, that was kind of…. what they were trying to figure out was if they could induce a placebo response and that was based off of the different variables they found that the number of office visits that patients have and the information given about the drugs. So in that sense, you couldn’t do that with animals but it had to do with communicating that sense. But yea, I didn’t come across anything in particular. (Pres.B. 19:30-20:02)

Additionally, B.S3 (who had researched current anatomical and chemical explanations for the placebo effect) and Sam (who had focused on ethical implications of placebo use) also answered the questions posed by drawing upon various aspects of their knowledge. In responding to FB’s question, students drew upon their knowledge as developed through their specific area of research, as well as their generalized, integrated knowledge of the topic as a whole. In the days following the presentation, each member was expected to submit their completed peer evaluation rubrics and their final personal goal reflection to FB.

Overall, the group was successful with their presentation and project as a whole. FB was responsible for evaluating the group on the Group Process and Presentation components of the project. He gave the students a score of 25/25 on the Group Process component and a score of 24/25 on the Presentation component. In an interview conducted at the end of the term, FB commented on why he had graded Group B the way he had. In regard to the group process mark, FB commented “they were able to organize their information in a coherent and logical manner and they were also able to incorporate multimedia into their presentation” (I.FB. 197-199) In regard to the presentation grade, FB said, “I think their presentation was relatively successful as reflected by the feedback they received from the instructor as well as their peers” (I.FB. 200-201).
Experiences during the Inquiry Process

Heather and Sam’s participation in the interview component of this study allowed them to reflect and comment on their experiences throughout their engagement with the project. In this section, the results of these individual experiences are presented.

Heather’s experiences. During the Inquiry Project, Heather was observed as she engaged in facilitated and unfacilitated work time. Further, she participated in a second interview conducted part way through the project on March 4th, 2013. Based on analysis of this data, the following themes emerged of Heather’s experience.

Interest, relevancy, and motivation. As Heather worked with her group to select and initially research the inquiry topic, she was focused on the concepts of interest and relevancy. She emphasized to her group mates the importance of selecting a research topic that would be feasible and easy to investigate, and the importance of feeling excited and interested in the topic they chose. Heather was interested in the placebo topic selected because of its applicability to everyday life:

I think we’re just really interested in how it works and we see that there’s, it’s very applicable to a lot of people and a lot of things and I think we are just all interested in how the power of suggestion presents, like something we think can actually have biological and anatomical effects so we are just really interested in seeing the connections between those two things. So that’s why it’s important I guess. (I2.Heather. 159-164)

I think the Inquiry Project is probably like the most relevant thing to daily life. For example, you can pick a topic that you are interested in that you think, for example, is relevant I mean, like I gave for the example, um… looking at side effects on drugs and how that influences your reaction to the drug – I think that by understanding the anatomy of that it will, I mean, just be interesting to me in daily life and relevant when I get prescriptions. (I2.Heather, 526-531)
Heather’s interests were not only related to relevancy, they were also motivating: “if motivation is increased by interest maybe I am more motivated because I am more interested in what we are doing because we have a topic picked that I am interested in” (I2. Heather. 446-448).

**Group work and collaborative roles.** In describing the group’s efforts, Heather tended to refer to the group as a whole, talking of the work they had been doing collectively. For example she said, “basically right now we’re just kind of finalizing our research question and I guess we’ve been doing like research towards it” (I2.Heather. 24-25) and “We’re trying to figure out if we want to focus on more just what is the power of suggestion and how does it relate to anatomy or we are trying to figure out if we want to see the clinical implications of it” (I2.Heather. 44-46). Heather described her work with the group by saying that:

> We’ve all had pretty similar roles up to until point because we have all just kind of been trying to fig – first of all – figure out a topic so everyone went home and researched something that they thought was interesting and then trying to find more information on a specific topic, we’ve all kind of been doing the same things, but I feel like once we start to plan the presentation more we will get more individual roles based on like our personalities and our strengths and where we might see ourselves in that, I guess. (I2. Heather. 272-279)

**Sam’s experiences.** Like Heather, Sam was also observed as she engaged in the project. Further, Sam participated in a second interview partway through the project on February 25th, 2013. From analysis of the data collected from these sources, the following themes emerged.

**A collaborative attitude.** Sam took a collaborative attitude towards her engagement in the group and saw her work with the group as a collaborative effort. Sam regularly referred to the group as a whole and said “we” instead of “I” in describing the group’s research activities. For example, “So we all kind of brainstormed ideas and gave in topics ideas which we decided would be like the placebo effect because it was a topic that we were all interested in” (I2.Sam. 22-24),
and “during our meetings, we decided what our next steps would be and what we were planning to do” (I2.Sam. 66-67).

The following example demonstrates the collaborative attitude Sam took towards the project. When the group was working to devise a timeline and deadlines for presentation development, Sam helped manage the conversation with a diplomatic tone. For example, she suggested that they should outline their topic into chunks then divide the research between each member to investigate further, report to the group, and develop a section of the presentation. When it came time to selecting a topic, Sam said, “I am interested in the clinical applications, so if anyone else wants that one I am welcome to give that to them” (FM3.B. 771-772), as a way to both declare her interests and diplomatically offer the topic up to others who may share her interests.

**Increased motivation with interest and autonomy.** At the time when the group was devising their presentation outline and assigning individual areas for further investigation, Sam had opted to focus her work on the final section of the presentation – the clinical implications of placebo usage. Sam had been inspired to focus on this section because of what she had found through her initial research efforts. Sam had come across a book titled *Mind over Mind: The Surprising Power of Expectations* by Chris Berdik. The book was so intriguing to her that she had purchased a copy after learning that the campus library did not hold one. When she first told her group about her discovery, Sam gave numerous examples from the book and spoke of its extensive citation list that she had reviewed and made use of. Of particular interest was the book’s discussion of the ethical considerations to the use of placebo treatments. Finding this book spurred her interests and contributed to her changing attitude of the project. At the outset, Sam was feeling unmotivated, not knowing what topic the group would select or what would happen. Once the topic was selected however, Sam’s motivation increased as the topic and research was of interest to her. In comparison to her other academic responsibilities that term, the Inquiry
Project was “one of the more interesting things” (I2.Sam. 344) Sam found herself engaged in. She was “swamped” (I2.Sam 345) with midterms and evaluations in her other courses, but the Inquiry Project stood as something different:

   I think the Inquiry Project is a great way for me to learn especially set things at my own pace instead of always cramming in like tests and exams and midterms. I find that I am learning better through reading and discovering by myself without the pressure of ‘oh I have to memorize so-and-so information and I have to regurgitate it all like within this hour’ kind of thing so I am finding it’s a good way for me to learn and I am actually learning a lot from it because I feel less under the pressure of just memorizing kind of facts. (I2.Sam. 393-400)

Overall, Sam was feeling in control of her learning. She felt she could work at her own pace and choose what to research based on her interests. She said, “We get to learn through ourselves instead of just having information just given to us” (I2.Sam. 486). Sam’s interest in the Mind over Mind book and her resulting focus on the ethics section serves as a poignant example.

Peer Evaluation Component

The peer evaluation component of the project required the group design a rubric that each student would then use at the end of the project to evaluate his or her other group mates. At the beginning of the project, the students worked together to design a peer evaluation rubric. This work was initially facilitated by FB. During the first facilitated meeting, FB had asked the group, “What are some of the traits that you think peer evaluation should be based on for this project?” (FM1.B. 237-238), and later on, “What do you guys think is fair to be evaluated on… for this project… by your peers?” (FM1.B. 256-257). These questions stimulated the group to discuss what measures they would include on their peer-evaluation rubric and how they would conduct their evaluation of one another. For example, the following conversation transpired:
Heather: “I feel like if we have more peer evaluations and then we share them with one another then we will better understand what people are expecting…like sometimes, you know you cannot be thinking that you’re not pulling your weight but if people tell you that you aren’t then you are like wow, ok well I will change what I am doing to better help everyone else and then I know”.

B.S3: “I think that is a pretty good idea – the whole, the regular evaluations but not have them count. That way we can also keep track of one another”.

Sam, “especially if we are regularly evaluated then it will be nice for us all to be able to say to one another well this is why you are doing well”. (FM1.B. 318-330)

Following this initial conversation, Group B collectively authored a peer evaluation rubric (Table 6.2). This rubric consisted of six measures: attendance, participation, cooperation, preparation, quality of research, and presentation. Shortly after designing this rubric, the group submitted it to FB. Group members then used the rubric to assess their peers at the end of the project. Completed rubrics were submitted to FB who tallied and averaged the scores for each student.
Table 6.2.

*Group B’s Peer Evaluation Rubric (PE.B.1-34)*

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<th>2</th>
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<tbody>
<tr>
<td><strong>Attendance – Percentage of</strong></td>
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<tr>
<td><strong>meetings attended</strong></td>
<td>Attended no</td>
<td>Attended 20% of meetings</td>
<td>Attended 40% of</td>
<td>Attended 60% of</td>
<td>Attended 80% of</td>
<td>Attended 100% of</td>
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<td>meetings</td>
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<tr>
<td><strong>Meeting Dynamics:</strong></td>
<td>Did not participate in</td>
<td>Rarely participated in</td>
<td>Discussed minimally</td>
<td>Participated</td>
<td>Usually participated,</td>
<td>Brings good ideas to</td>
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<tr>
<td><strong>Participation</strong></td>
<td>discussion</td>
<td>discussion, lack of</td>
<td>with group, minimally</td>
<td>occasionally,</td>
<td>brought some ideas to</td>
<td>the meetings,</td>
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<td></td>
<td></td>
<td>involvement</td>
<td>helped in facilitating</td>
<td>sometimes helped</td>
<td>the meetings</td>
<td>articulating their</td>
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<td>brainstorming</td>
<td>brainstorming with</td>
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<td>point with research to</td>
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<td>the group</td>
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<td>back it up</td>
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<td><strong>Cooperation</strong></td>
<td>Did not listen to</td>
<td>Rarely paid attention</td>
<td>Occasionally listened</td>
<td>Usually listened to</td>
<td>Listened to others</td>
<td>Listens attentively to</td>
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<td>others’ ideas.</td>
<td>to the ideas of others.</td>
<td>to other’s ideas but</td>
<td>others ideas.</td>
<td>ideas and sometimes</td>
<td>other’s ideas and gave</td>
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<td></td>
<td>Became angry</td>
<td>Was domineering or</td>
<td>was often distracted.</td>
<td>Listen to</td>
<td>gave input. Usually</td>
<td>their own input on</td>
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<td></td>
<td>when criticized.</td>
<td>unengaged. Did not</td>
<td>Could not take and</td>
<td>criticism but only</td>
<td>accepted and applied</td>
<td>their ideas, accepting</td>
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<td>pay attention to</td>
<td>apply criticism very</td>
<td>occasionally applied it.</td>
<td>criticism.</td>
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<td>gives space for other</td>
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<td>members to talk.</td>
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<tr>
<td><strong>Outside of Meeting:</strong></td>
<td>Did not prepare at all</td>
<td>Rarely prepared for</td>
<td>Incomplete preparation</td>
<td>Occasionally finished</td>
<td>Usually prepared for</td>
<td>Completely prepared for</td>
</tr>
<tr>
<td><strong>Preparation</strong></td>
<td>for meeting</td>
<td>meetings. Did not</td>
<td>to meeting. Sometimes</td>
<td>preparation for</td>
<td>meetings and brought</td>
<td>meeting. Assigned tasks</td>
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<td></td>
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<td>usually bring ideas to</td>
<td>brought in a good</td>
<td>meetings on time.</td>
<td>good ideas to discuss.</td>
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<td>discuss.</td>
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<td>Usually brought in</td>
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<td>a good idea.</td>
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<tr>
<td><strong>Quality of Research</strong></td>
<td>No research done</td>
<td>Sometimes brought in</td>
<td>Did a little research</td>
<td>Brought in research,</td>
<td>Brought in suitable</td>
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<td>one article. Research</td>
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<td>was not generally</td>
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<td>reliable or relevant</td>
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<td><strong>Presentation</strong></td>
<td>Did not participate in</td>
<td>Was rarely involved in</td>
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<td>Generally participated</td>
<td>Usually participated in</td>
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<td>Did not contribute to</td>
<td>Was rarely involved in</td>
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<td>presentation.</td>
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<td>the material.</td>
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Overall, the students rated each other very positively. Scores ranged from 28.7/30 to 30/30 with an overall average of 29.1/30. Two students (B.S1 and B.S2) wrote qualitative comments of their group mates. Comments were generally positive. For example, B.S1 wrote, “[Sam] was always well-prepared for the meetings. She did some excellent research on topics in the current medical field that used placebos” (PG3.BS1.). Overall, it is clear from these scores and comments that students thought of their group mates as strong contributors.

**Personal Goals Component**

Each student was expected to set a personal goal for themselves at the outset of the Inquiry Project and devise an action plan for making progress on the goal over the length of the project. Table 6.3 provides a summary of each student’s goal, their rationale for selecting it, and an example of the success they reported to have made across the term.
### Summary of Group B’s Personal Goals

<table>
<thead>
<tr>
<th>Student</th>
<th>Goal</th>
<th>Rationale</th>
<th>Evidence of Success</th>
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<tbody>
<tr>
<td>B.S1</td>
<td>Improve time management skills to become better organized with studies and assignment completion</td>
<td>I have never had difficulty completing assignments on time but I have always tended to leave studying and the completion of assignments to the last minute since high school. My goal is to become better organized with my studies and to complete all assigned work on the same day that it is assigned or well before the due date so that I am not rushed to complete assignments or complete readings when I should be studying or have other commitments. (PG1.B.S1. 6-12)</td>
<td>I feel that my study habits have significantly improved due to the focus I have put on completing my readings within a timely manner after a lecture. (PG2.B.S1. 36-37) Now that we are in exam time I have really seen the benefits of completing all readings on time [...] This project has allowed me to really ensure that I stay on top of all my course work in all my courses (PG3.B.S1. 5-6, 9-10)</td>
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<tr>
<td>B.S2</td>
<td>Ensuring the [Inquiry] presentation is engaging and entertaining for the audience</td>
<td>B.S2 developed his goal after noting that the guest lecturers invited to his courses in the past had either lost the student audience or highly engaging: What differentiates these [guest lecturer] presentations to the ones which are easily forgotten by students is the presenter’s ability to obtain the audience’s interest. The guest speakers who presented their material in an effective and appealing manner gained more students’ attention. (PG1.B.S3. 11-14)</td>
<td>In summary, my personal goal appears to be developing quite nicely over the past few weeks, and should be achieved the time of our presentation. I am really enjoying this project so far and the unique learning opportunities it brings. I look forwards to the presentation! (PG2.B.S2. 35-37)</td>
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<td>B.S3</td>
<td>To improve long-term planning by organizing her school schedule and setting smaller, more manageable goals for larger projects.</td>
<td>I do not currently have any establishment of a schedule to help me work towards meeting these due dates on time. As a result, I tend only to focus on my assignments that are due soonest. This is not practical when considering larger assignments, or assignments with multiple steps, such as [the Inquiry Project] (PG1.B.S3 8-12)</td>
<td>Although [the Inquiry Project] will soon be completed, this experience has encouraged me to think of some ways that I could improve in preparing for projects in the future. I found that the most helpful strategy I used to improve my long-term planning was putting all of my due dates into a calendar and referring to it more frequently. (PG2.B.S4, 27-30)</td>
</tr>
<tr>
<td>B.S4</td>
<td>Implement a structured schoolwork schedule to develop time management skills and improve academic performance.</td>
<td>Procrastination has been a big problem for me in my one and a half years of university thus far. Without homework to hand in and a concrete work plan, I find that I tend to leave work and studying until a day or two before the exam or due date. (PG1.B.S4, 3-5)</td>
<td>Generally, I think I have achieved most of my personal goals for this project. I have been more organized and managed my time better since the first reflection before reading week. (PG1.B.S4, 28-31)</td>
</tr>
<tr>
<td>Sam</td>
<td>Time management</td>
<td>As university life gets busy, it’s really hard for me to find time to do...</td>
<td>Overall, I think making this schedule and having to keep a log of it to...</td>
</tr>
<tr>
<td>Heather</td>
<td>Stress management with the ultimate goal of reducing overall stress levels</td>
<td>This goal is important to me because reducing stress is important to both my physical and mental health. Ultimately, I think most of the stress that I experience at school is due to a lack of effective time management coupled with very high expectations that I set for myself. (PG1.B.Heather, 3-6)</td>
<td>As well as removing distractions, I think my stress level has really decreased because I have not been leaving my goals to be completed till the day before they are due at the group meeting. (PG2.B.Heather, 17-19)</td>
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</table>

While each student’s goal was unique, there were some commonalities to the focus of their goals, including time management, organizational skills, and stress. All six appeared to draw on their experiences as students, their self-identified struggles, and skills related to the Inquiry Project. B.S4 identified procrastination as a common problem arising out of her schoolwork; Sam found university life busy and stressful; B.S2 drew on what he had observed in lectures and other courses. Students regularly recognized what impact achieving their goal would have on the Inquiry Project, for example, B.S2’s goal of developing skills for engaging an audience informed his contributions to the Inquiry Presentation. Students also recognized the value their goal would have beyond the Anatomy Course – either in application to other courses or future endeavors. For example, B.S1 noticed an improvement in time management as he engaged in final exams and expressed how his new skills would be applicable to all his courses.

Since Heather and Sam could elaborate on the personal goal component of the project through participation in their interviews, in depth perspective on their experiences of engaging in the personal goals component follows.
**Heather’s personal goal.** The Inquiry Project served as an opportunity for Heather to focus on and refine her time management skills. In the first facilitated meeting, FB asked each student what he or she hoped to learn from the project. In response, Heather shared a desire to learn better time management skills. Based on this, Heather chose to set a personal goal for the Personal Goals Component that focused on improved scheduling and goal setting with an aim to reduce stress levels and “consequently, be a happier, healthier individual” (PG1.Heather. 13-14).

In her first Personal Goals Reflection, Heather wrote, “Ultimately, I think that most of the stress that I experience at school is due to a lack of effective time management coupled with very high expectations that I set for myself” (PG1.Heather. 4-6).

As the project progressed, Heather set goals for herself and set realistic time constraints for goal completion. For example, setting a goal to organize the research she had completed and brainstorm ideas for the inquiry topic (Figure 6.6). For each goal, Heather tracked her ability to complete the goal within her given time constraint, how realistic her goal had been, if she had been able to manage her time without distractions such as Facebook and her cell phone, and her self-rated level of stress while completing the goal.

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<thead>
<tr>
<th>SETTING GOAL:</th>
<th>AFTER COMPLETION OF GOAL:</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do I plan to accomplish before the next meeting? (Next meeting Feb 25th)</td>
<td>Organizing research and brainstorming ideas for research question.</td>
</tr>
<tr>
<td>When will I do the work and how much time will I spend working?</td>
<td>30 mins on Feb 24th</td>
</tr>
<tr>
<td>WAS I ABLE TO COMPLETE MY GOAL WITHIN THE TIME CONSTRAINT?</td>
<td>YES.</td>
</tr>
<tr>
<td>WAS MY GOAL REALISTIC GIVEN THE TIME CONSTRAINTS, OR WERE MY EXPECTATIONS OF WHAT I SHOULD ACCOMPLISH TOO HIGH?</td>
<td>YES.</td>
</tr>
<tr>
<td>WAS I ABLE TO EFFECTIVELY MANAGE MY TIME WHILE WORKING OR WAS I DISTRACTED OFTEN?</td>
<td>YES.</td>
</tr>
<tr>
<td>HOW STRESSED WAS I WHILE COMPLETING THIS GOAL? (1 = NOT STRESSED, 10 = VERY STRESSED)</td>
<td>1/10</td>
</tr>
<tr>
<td></td>
<td>This meeting did not require much preparation at all, therefore I was not stressed at all.</td>
</tr>
</tbody>
</table>

*Figure 6.6. Heather’s goal tracking system. (PG2.Heather)*
Even with the progress made on accomplishing her goal, Heather had found it challenging to manage her time and academic expectations. She felt she had limited time to dedicate to the Inquiry Project given the demands of her other classes and assessments. With such a demanding academic load, Heather explained: “we may want to spend a lot of time on certain things but we just honestly don’t have the time to do everything and so that makes it tough” (I2.Heather. 490-492). Heather explained that the Inquiry Project was interesting because it was a chance to explore a topic of interest that extended beyond the course material, however, this exploration took time. With all her other course requirements and responsibilities Heather felt strained to give as much attention to her work as she might like to.

Sam’s personal goal. Sam was careful and meticulous with her studies yet, she felt she struggled with procrastination and had trouble concentrating. She said, “it’s really hard for me to find time to do everything I want to without procrastinating” (PG1.Sam. 5-6) and “it’s really hard for me to actually keep to my [schedules and timelines]” (PG1.Sam. 7-8). Given these challenges, Sam chose to focus her personal goal on time management and scheduling, acknowledging that “it’s something that I have wanted to improve on for a long time now” (PG1.Sam. 4). Sam set out with the intention of creating a schedule for herself and logging her work to document how she was spending her time as exemplified in Figure 6.7.
In her last written reflection, Sam wrote:

Throughout this inquiry assignment, I learned a lot of things that I normally don’t get to learn in class […] It used to be that I procrastinated a lot and end up really stressed when things would all be due the next day, however since I made the schedule for this project, I realized that when I gave myself more time and forced myself to start earlier it became a lot less stressful to do. (PG3.Sam. 1, 3-5)

Overall, Sam used the personal goal component to make improvements upon a previously disregarded, but important, aspect of her student life.

**Overall Experiences and Reflections after Inquiry**

After the Inquiry Project was complete, I met with Heather and Sam individually for one final interview. During these interviews, the students reflected on their experiences of the Inquiry Project as a whole. Analysis of these interviews revealed overall themes of Heather and Sam’s
experiences. In addition to student interviews, an interview was conducted with FB (the facilitator of Group B) to collect his reflections on his experiences and observations as a facilitator. Analysis of these interviews revealed overall themes of such experiences and are presented in the remainder of this section.

**Heather’s experiences.** The final interview with Heather was conducted on April 5th, 2013 and two major themes emerged of her experiences overall.

**Inquiry as a fun and interesting chance to do something different.** In describing the project overall, Heather regularly used the word “fun”, for example, “I had fun” (I3.Heather. 635) and “I thought it was really fun” (I3.Heather. 732). In addition, “It was interesting to do something different” (I3.Heather. 241). Heather enjoyed the project because it “wasn’t [her] typical learning experience” (I3.Heather. 238) and she could “learn things in a different way” (I3.Heather. 268). What made the learning experience so different was the way that Heather got to work with others. For example, she said:

> Overall I thought it was a good project. I thought it was… I really liked working in a group, I thought that was really fun, I liked meeting people in my program because I think that a lot of time a lot of people would like to meet people but it is more difficult when you are in the lecture environment so I thought that was good. (I3. Heather. 731-735)

Additionally, Heather thought the project was fun due to the way in which, “we got to pick something that we were interested in” (I3.Heather. 250). Overall, what Heather found most interesting about the project was the way in which the topic related to her personal life:

> I think now, I’ll see random things on the placebo effect in the news and I will think oh cool that is interesting. I know a bit more about the science behind it – it is more applicable and I see things in a different way about the placebo effect. (I3.Heather. 253-256)
**Unclear expectations.** Despite Heather’s positive experiences with the Inquiry Project, she was regularly confused and felt unclear about various aspects of the project, specifically, the expectations around the personal goals, facilitated meetings, and presentation. For example, she said, “Sometimes though, [in] the facilitated meetings I would be like I don’t even know what I am supposed to be doing so it was hard to set myself that goal, or something to get done for it” (I3. Heather. 478-486), and “It was kind of unclear what we were actually supposed to be accomplishing during that facilitated time” (I3. Heather. 472-473). When speaking about the presentations, Heather said, “Sometimes we weren’t really sure what needed to be done or what was expected of us at like certain points, like for example, we didn’t know when we were presenting” (I3. Heather. 333-335).

Overall, Heather’s was confused about the project’s expectations and how this was being communicated, however, she did not blame her facilitator for the confusion. Rather, she felt FB had served to answer questions and clarify expectations: “I felt like his role was to answer questions that we had throughout the project like what we were really, like what was expected of us, um where we had to take the project, I guess” (I3.Heather. 323-325).

**Sam’s experiences.** The final interview with Sam was conducted on April 10th, 2013 and three major themes emerged of her experiences with the project overall.

**Development of research skills.** In speaking of her experience of the project overall, Sam emphasized how meaningful the project had been to her. In other courses, Sam felt she was being “forced to memorize” (I3.Sam. 590) information, however, the Inquiry Project felt refreshing due to the way in which she was learning more effectively and exploring interests at her own pace. This autonomy had an impact on her research and information literacy skills and appeared to have an impact in two ways.

First, Sam’s attitude towards academic literature and its usefulness changed. Previous to the Inquiry Project she had trouble understanding journal articles: “it’s not the easiest thing to
understand and it takes time to read through. When you’re forced to read it on something you 
really don’t care about you just never understand it, and it’s just really boring to do” (I3.Sam 593-
596). As Sam’s interest in the Inquiry Project topic grew, however, she found it easier to read and 
understand academic literature: “When I realized that I was actually interested in this topic, 
combing through the words and trying to figure out what the journal article was about was 
significantly more fun and significantly easier than trying to do it on something that you don’t 
care about” (I3.Sam. 596-599).

Second, Sam felt she learned how to effectively summarize, consolidate, and 
communicate the academic literature she was reading. As she engaged in her research Sam found 
a plethora of information. In doing so, she realized the importance of identifying a main argument 
as well as summarizing and consolidating information before communicating it to others: “I think 
it’s important to know how to research, and know how to pick through articles that are relevant” 
(I3.Sam. 631-632). She said she learned “how to summarize, how to figure out what was the more 
important part, and how to relate back to others’ work, when you’re working as a team” 

“A whole world of ethics”. Sam was motivated to engage in the project due to the 
autonomy she felt in exploring her interests. Toward the end of the project, Sam’s attention 
turned toward the ethics of placebo use. As the project came to a close, she sensed her interest in 
the topic would have a lasting impact. The project had “brought [her] into the world of ethics” 
(I3.Sam. 605-606) and this was so interesting that she thought she “might even end up taking a 
course on ethics” (I3.Sam. 606-607). What she found most intriguing about the topic was the way 
in which there were no clear answers to be found:

It’s like there’s a lot of these questions where I actually can’t answer, like I can’t figure 
out an answer to and there is no right answer to and that is the thing that I thought was 
really cool, because there is no right answer. We are so used to questions that have a right
or wrong answer so within this field it’s kind of like, it’s in between...like we don’t know, I don’t know what to answer. (I3.Sam. 622-626)

The above comments demonstrate how Sam developed a new interest in learning and how she had come to embrace messy, complex questions with no clear answers, all as a result of her engagement in the Inquiry Project.

**The project wasn’t worth enough.** Sam’s experience of the Inquiry Project was not wholly positive. The project was too demanding and took too much time to complete given the amount of marks it was worth. She commented, “We put so much time into this. The time you put in is kind of not worth the amount of marks it was worth” (I3.Sam. 220-222). The Inquiry Project comprised 15% of the students’ overall course grade. In adequately reflecting the nature of the project, Sam thought it should be worth at least 20%. She recognized, however, that it would be difficult for course organizers to balance each component of the course:

I realized the three block exams and the two practicals are very important to anatomy, like it’s not like - I can’t see it being dropped. I also feel like we put in so much effort into inquiry, that it has to be that it could be worth more, so it’s a toss up, it’s hard. That’s why I’m glad I don’t have to plan courses. (I3.Sam. 739-743)

**FB’s experiences.** FB was interviewed on April 20th, 2013. Four major themes arose of FA’s role, experiences, and observations arose through analysis of the interview transcript.

**Drawing on past positive experiences as a student.** FB was initially motivated to become a facilitator for the Inquiry Project because of the positive experience he had had as a student the year before. During the first facilitated meeting, FB explained this to his group by saying:

I was part of this project last year as a student and I really enjoyed the experience of working with others and also learned a lot from this experience in terms of how to handle group dynamics communication skills, as well as organization skills. That’s why I’ve
decided to volunteer as a facilitator this year so I can share that experience with you guys. (FM1.B. 60-64)

FB described his role of facilitator as that of an observer. He aimed to offer the group some initial direction followed by guidance through questioning and quiet observation of the group’s progress. FB explained:

I observed their group process – who was talking with whom and also who was proposing ideas, who was following up on ideas and I also evaluated them based on the group process, and when they are going off track in their process or they are having trouble finding some topics or having trouble making progress I can step in and potentially give them a little bit of direction in terms of which way they should proceed and when they ask me questions to get information regarding the project, my response is often a question to them so these questions are meant to direct them to specific topics and fields where they are likely to find the answer to their own questions. (I1.FB. 93-102)

As the project progressed, FB’s role was a mix of initial guidance, directed questioning, and observation of the group’s efforts. As part of his duties, FB was also responsible for collecting and evaluating students’ personal goal reflections as well as the final presentation.

Sensing students’ initial unease and then growing sense of comfort. Through his observations of Group B’s engagement with the project, FB noted how students became more comfortable with the project over time. At the beginning of the project, FB sensed that students were “feeling a little bit uneasy” (I.FB. 220) about the project. He attributed this feeling to multiple factors. First, the Inquiry Project was the first time many students had been asked to participate in a group assignment at the university level. Many of the students, thought FB, were uncomfortable with the arrangement. Second, FB noticed that students seemed initially confused about the project and what was expected of them. Finally, students needed time to get to know their group mates before they could feel comfortable with each other. By observing his group
across the facilitated meetings, FB noticed how initial unease gave way to a growing sense of comfort both with project and one another:

By the third facilitated meeting, I think they got a little bit comfortable with each other and with the project [...] I think they became very comfortable with the project and they started to suggest presentation ideas and they were able to organize their information in a coherent and logical manner. (I.FB. 193-198)

Overall, through his observations of the group, FB noticed how students developed a sense of comfort both with the project and with one another as the project progressed.

**Observing the group sorting out ideas based on interests.** In addition to being a facilitator for Group B, FB was also a facilitator for two other Inquiry groups who were not part of this study. FB made comparisons between all three of his groups and how they worked to incorporate students’ interests into the project. Decisions were consistently made around each member’s individual interests. Students may have come to their group with different ideas and interests, but all three groups made a concerted effort to accommodate these unique interests in stitching together a coherent project:

I think everyone has different ideas about what they should do in the Inquiry Project and they all propose their ideas their first meeting and what the groups often try to do is trying to incorporate as many ideas as possible into one mega idea that they can divide into several aspects and each aspect will contain some interesting topics that people can research. (I.FB. 241-245)

Regarding Group B specifically, FB saw how their topic of the placebo effect incorporated each students’ interests: some of the students were interested in biochemistry and focused on chemical impact sugar pills could have on the body, others were interested in the physiological aspects of placebo and focused on how placebos changed the body’s physiology, and others were focused on the ethical considerations such as whether or not it is appropriate for
doctors to prescribe placebos. Overall, FB’s Inquiry groups, including Group B, found ways to allow each student to focus on an aspect of the project that was interesting to them, developing their investigation out of the various areas of focus.

_noting students’ increased knowledge and skills._ FB believed the Inquiry Project was a positive learning experience for students, and that students came away with increased knowledge and skills in three main ways. First, by engaging in the project students learned “a great deal about the topic” (I.FB. 366) they investigated. In addition to learning scientific facts, students also learned about the social and ethical aspects of their questions. Second, they developed “not just knowledge but a method of learning” (I.FB. 405) – they learned “how to ask a question, how to research based on the question and how to find a solution or answer to their own question” (I.FB. 405-406). Finally, the students came away with new skill sets related to working in a group – “how to work effectively in group setting, how to manage group dynamics and how to work with individuals with different knowledge backgrounds and different personalities” (I.FB. 369-370). Overall, by developing knowledge and skills in these three ways, FB thought the Inquiry Project gave students valuable tools that would be useful to them as they went on in their educational careers.

**Chapter Summary**

This chapter has focused on Group B. Overall, Group B completed the Inquiry Project successfully. The group selected a topic – the placebo and nocebo effect – after brainstorming multiple ideas and conducting some initial research. Once the topic was selected, individual students found research on the topic in general, and after sharing what each person had learned, the group formulated an initial research question of: How can the power of suggestion be used by medical professionals to enhance or detract from the efficacy of treatment for certain conditions? They then developed a presentation outline, subdividing the presentation into sub-sections. Each student selected a sub-section, conducted further research, and prepared a two- to three-minute
speech for the presentation. They authored and filmed two videos (an introductory music video based on the *Big Bang Theory* television show and a silent film case study example) that were incorporated into the presentation in an effort to engage the audience and tell a story related to their research question. After some rehearsal, the group performed their presentation to an audience of other anatomy students, their facilitator, and Prof to answer the Inquiry Question: How does the power of suggestion relate to neuroanatomy and neurochemistry? What clinical implications does this have?

FB, who served as the group’s facilitator, considered his role to be that of an observer. He observed how the group developed a sense of comfort with each other and the project over time. The group used each other’s individual interests to shape and inform their investigation, accommodating each other and ensuring each member was working on something that excited them. Overall, FB thought the Inquiry Project enabled students to develop in-depth knowledge about their subject as well as improve upon their research and group work skills.

Two students from Group B – Heather and Sam – participated in the interview component of this study to share their experiences as students of the project. Both students reported similar experiences from beginning to end. Both Heather and Sam felt they knew very little about the project before it began. As Sam described it, the Inquiry Project was a scary mystery with little information made available about what was expected. As the students worked with their group, they both felt the work was collaborative in nature and described the group’s efforts as teamwork. Both students developed a strong sense of motivation for working on the project because of the way in which the topic and their foci were of interest to them.

By the end of the project, both students described having had positive experiences. For Heather, the project came to serve as an opportunity to be creative and have fun with learning. Sam on the other hand felt she had developed strong research skills and had discovered a newfound interest in medical ethics. Despite these positive results, both students shared negative
feedback about the project as well. Heather felt she never fully gained clarity on what was expected of her throughout the facilitated meetings and presentation. Sam thought the grade value of the project (the overall 15% of the students’ final grade) was not enough to match the amount of effort and time required of the project.

The next chapter, Chapter 7, follows a similar structure to that of this current chapter, in that Group C’s process for inquiry engagement, the personal goals, and peer evaluation components are presented. Vignettes from Group C participants highlight students’ experiences of engagement throughout.
Chapter 7

Group C

This chapter focuses on Group C – how the students engaged in their group work and made progress on the project, as well as the experiences of group members throughout their engagement. To review, Group C consisted of two men (Caleb and C.S3) and four women (Jane, C.S1, C.S2, and C.S4). All six students in Group C were in the second year of Life Sciences studies. Group C’s facilitator, FC, was a fourth year Life Sciences student who was completing an honours specialization degree. FC had been a student of the Inquiry Project two years prior (in 2011). She had served as a facilitator in 2012 and was serving for the second time in 2013. Study participants Caleb and Jane were interviewed throughout the term. Additionally, FC was interviewed at the end of the term.

Table 7.1 summarizes Group C’s engagement with the project, organizing the work into three categories: (1) the inquiry process itself – progress on the inquiry topic, question, research, and presentation; (2) the personal goals component of the project; and (3) the peer evaluation component of the project. The Inquiry Process is further organized into seven stages: getting started, organizing research, question formation, distributed collaborative work, presentation development, presentation rehearsal, and finally, the presentation itself. These stages were author-derived based upon observation and data analysis of the activities and actions Group C engaged in throughout the project.

This chapter is organized based on the categories and stages outlined above. First, the group’s inquiry process and its seven stages are presented. Following this, the personal goal and peer evaluation components are discussed. Throughout these sections, vignettes of Caleb, Jane, and FC’s experiences are interwoven into the text to illustrate these individuals’ lived experiences of the project. Finally, the chapter concludes with a consideration of Caleb, Jane, and FC’s reflections of the project once it was complete.
Table 7.1.
Timeline of Group C’s Progress

<table>
<thead>
<tr>
<th>Dates</th>
<th>Meetings</th>
<th>Inquiry Process</th>
<th>Personal Goals</th>
<th>Peer Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 30</td>
<td>Facilitated Meeting #1</td>
<td>Getting Started</td>
<td>• Instructions on expectations</td>
<td>• Instructions on expectations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clarified roles, goals, and expectations for the project</td>
<td>• Brainstormed ideas</td>
<td>• Began work on peer evaluation rubric</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Discussed pros and cons of inquiry learning</td>
<td>• Brainstormed potential topic ideas</td>
<td>• Complete peer evaluation rubric</td>
</tr>
<tr>
<td>Feb. 11</td>
<td>In-Class Period #1</td>
<td>Initial Research and Topic Selection</td>
<td>• FC facilitated discussion of personal goals</td>
<td>• Submitted peer evaluation rubric to FC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Explored literature on possible topic areas</td>
<td>• Submitted first personal goal reflection to FC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Selected a conjoined twins case as topic of focus</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Feb. 11</td>
<td>Facilitated Meeting #2</td>
<td>Question Formation and Individualized Research</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Divided research responsibilities focused on organs</td>
<td>• Submitted first personal goal reflection to FC</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Agreed on wording for initial Inquiry Question</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Feb. 25</td>
<td>In-Class Period #2</td>
<td>Adjustments and Continued Individualized Research</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shared research found on organs</td>
<td>• Submitted first personal goal reflection to FC</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Adjusted focus of topic and research to how body systems coordinate for various conjoined twins</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Mar. 5</td>
<td>Facilitated Meeting #3</td>
<td>Presentation Development</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Revised Inquiry Question</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Selected types of twins to investigate further</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Divided selected twin types between pairs</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Mar. 25</td>
<td>In-Class Period #3</td>
<td>Presentation</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Brainstorm ways to make the presentation engaging</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Develop creative theme for the presentation</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Mar. 25</td>
<td>Unfacilitated Meeting</td>
<td>Presentation</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Worked in their pairs to conduct and interpret research</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pairs developed their respective sections of presentation</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Incorporated creative theme into sections</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Mar. 27</td>
<td>Facilitated Meeting #4</td>
<td>Presentation</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Began composing a script for the presentation</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Apr. 2</td>
<td>Presentation</td>
<td>Presentation</td>
<td>• FC facilitated discussion of personal goals</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Gave presentation</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Apr. 5</td>
<td></td>
<td></td>
<td>• Submitted third and final personal goals to FA</td>
<td>•</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Submitted completed peer evaluation rubrics to FA</td>
<td>•</td>
</tr>
</tbody>
</table>
Inquiry Process

Getting started. FC got in touch with the students of Group C via email to arrange a first facilitated meeting. The group met on January 30th, 2013 in a small group room located within a university campus building. FC asked each person to introduce him or herself. After introductions, FC asked, “What questions do you guys have about [the Inquiry Project]? Anything that you want to ask right off the bat?” (FM1.C. 31-32), which stimulated students to ask numerous questions about what the expectations were for the Inquiry Question itself. Students were provided with the following response from FC:

FC: I think the best way to think about this is, this project is about whatever you guys want to study so it doesn’t have to be non-fiction and… it doesn’t have to be strictly anatomy, because anatomy is inter-related with so many subjects, right? So it could be physiology… so really it’s a way for you guys to explore, right? So ‘discover first, explain later’. It’s so broad that….

Jane: “So it can be like anything”. (FM1.C. 58-64)

FC then led the group in an activity. She divided the group up into two smaller groups of three and asked one trio to brainstorm all the strengths or benefits of the Inquiry Project and the other trio to brainstorm all the weaknesses or downsides of the Inquiry Project. The trios brainstormed, then shared their thoughts with one another. Table 7.2 provides a summary of the points that were brainstormed by the students.
Table 7.2.

*Brainstormed Strengths and Weaknesses of the Inquiry Project (FM1.C. 127-158)*

<table>
<thead>
<tr>
<th>Strengths/Benefits</th>
<th>Weaknesses/Downsides</th>
</tr>
</thead>
<tbody>
<tr>
<td>An opportunity to engage in group work</td>
<td>It could be overwhelming having no/few guidelines</td>
</tr>
<tr>
<td>The project will potentially raise our course grades</td>
<td>The work will be an added component to our schedule, co-ordination and timing with group members may be difficult</td>
</tr>
<tr>
<td>It’s a creative project, a different experience</td>
<td>What we learn may not apply to our future</td>
</tr>
<tr>
<td>We will learn new skills that are not just science</td>
<td>The project doesn’t tailor to all learning styles (particularly those who are independent learners)</td>
</tr>
<tr>
<td>based (i.e. presentation skills, communication skills)</td>
<td></td>
</tr>
<tr>
<td>Improving oneself through the personal goal component</td>
<td>The group could face conflict or clashes of opinion</td>
</tr>
<tr>
<td>A chance to meet other people in the program</td>
<td>The group may end up exploring a topic that is of interest to the majority but not of interest to the individual</td>
</tr>
<tr>
<td>“Expanding horizons” – a chance to learn about potential career directions other than medicine</td>
<td></td>
</tr>
</tbody>
</table>

Next, FC asked everyone to consider solutions for addressing the weaknesses of the project. For example, in addressing the identified weakness of difficulties with scheduling, the group engaged in the following conversation, where FC asks:

*What are other avenues [though which] you guys could meet?”*

Jane, “We could divide the group and meet less often just to compare the individual tasks that we assign”. Another student, “also do a lot of communication through email, or Facebook, or cyber so that we can collaborate our work without being in the same room necessarily. (FM1.C. 184-191)

After completing this activity, FC asked each member to share what he or she was hoping to get out of the Inquiry Project, which led to a discussion about the personal goals component. Students expressed confusion when FC asked, “Do you have any questions about what is due next week about your personal goal?” (FM1.C. 356-357). FC explained that the first personal goal reflection would be due in a week and that students’ reflections should consist of two components: a declaration of the student’s goal itself and an action plan for achieving it. FC
explained: “Basically, the goal has to be a ‘SMART’ goal. I am not sure if you guys have heard of that acronym before – specific, measurable, attainable, r – I can’t remember – and time-framed” (FM1.C. 368-370).

FC also talked to the group about the peer evaluation rubric, which would be due in their second facilitated meeting next week. She asked the group to brainstorm:

FC: What kind of things you want to see in your other group members and what you think is important in terms of… like what would be a good characteristic or things that a good member would do or should do?” (FM1.C. 373-376)

A discussion regarding the peer evaluation rubric ensued, and the group decided to create a Google Documents page where they could collaboratively compose a rubric based on their discussion. To wrap up the first facilitated meeting, FC clarified that their second facilitated meeting would be in one week, that their peer evaluation rubric and first personal goal reflection would be due at this time, and that they would spend some time brainstorming ideas for their Inquiry Question during the meeting. Following the first meeting, the group established a private Facebook group and Google Documents folder and made progress on their peer evaluation rubric by each working independently on the shared online document.

**Initial research and topic selection.** On February 11th, 2013 there was an in-class work period and the group spent some of their time completing their peer evaluation rubric. The remainder of the in-class work period was dedicated to exploring potential topic ideas for their Inquiry Question. To do this, each member worked on his or her personal laptop to search the Internet. They read news articles, visited a range of websites, and watched YouTube videos.

When the group met with FC for their second facilitated meeting later that same day, the group had decided on a topic. They told FC of the various topics they had considered including a rare condition that prevented a child from physically and mentally aging, and the anatomy of fictional characters such as The Hulk and Harry Potter. Ultimately, however, the group decided
on the topic of conjoined twins. They told FC how one student, C.S1, had been watching *The Learning Channel* (TLC) and had watched a program about a case of conjoined twins. The television program focused on the lives of Abby and Brittney – a set of conjoined twins living in the USA. The students expressed an interest in the twins’ anatomical design and shared with FC what they had learned about the girls’ anatomy by watching the TLC program:

C.S2: “They can feel one half of their body and they share organs above their belly buttons and below it…or they have separate organs above their belly button and then below it’s all shared”.

C.S1: “And they have separate hunger signals and like separate…”.

C.S2: “But they have one stomach?”

C.S1: “It merges to like one intestine”. (FM2.C. 240-250)

**Question formation and individualized research.** The students then spent the remainder of their facilitated meeting developing a plan for how they would proceed with their research. The students engaged in this conversation with little involvement from FC, who spent her time observing and taking notes. C.S1 proposed that each person investigate an organ system in an effort to explain how that system was configured within Abby and Brittney:

Jane: “What would be the six things that would be interesting about them?”

Caleb: “Do you mean as in part of their physical body?”

Jane: “I guess just something that you want to know about them”.

C.S3: “Something that interests you”.

Group members agree: “Yea”.

Jane: “A bunch of us probably have different things that we would want to know”.

(FM2.C. 558-572)

Each member then selected an organ system to focus on and the following notes were recorded into their Google Docs page (Figure 7.1)
Overall, the group agreed that their research should address the overall question of “How do these conjoined twins [Abby and Britney] function as opposed to regular people who are not conjoined?” (FM2.C. 528). Following this meeting, each student independently conducted research on their anatomical system and recorded notes of their research within a shared Google Documents page. When the group met again during the second in-class work period on February 25th, each member shared what they had learned through their investigation. In conversation, the group agreed that there was not enough research available on the specific case of Abby and Brittney alone. Rather, they would have to expand the focus of their investigation.

Adjustments and continued individualized research. Upon this realization, the group sought to expand the focus of their investigation. During the third facilitated meeting, students described this decision to FC:

C.S4: “Yea. We decided over reading week that there wasn’t… I don’t know… we were having difficulty finding stuff about Abby and Brittney”.

C.S1: “Because we split up over reading week to research different areas about Abby and Brittney but then when we came back after reading week we all realized that some areas were seriously lacking information”.

Jane: “Yea because like they are private, they don’t do extra medical testing so we don’t have that much information about them”.

Figure 7.1. Group C research selections (GD.C. 777-781)
C.S1: “So we broadened it to…”.

C.S2: “conjoined twins in general”.

C.S1: “Now we have separated the research to different types of conjoined twins. And we just kind of tried to find everything we could about the different types”. (FM3.C. 113-127)

In light of this decision, the group continued with their research by reassigning each member to investigate a particular type of conjoined twin (such as thoracopagus, parapagus, craniopagus, xiphopagus, and pyropagus twins). At the outset of the third facilitated meeting, C.S2 proposed that the group’s new research direction lent itself to a revised Inquiry Question of: “How is it possible for two people to live in one body?” (FM3.C.142-143). Throughout the meeting, students discussed what they had learned about each type of conjoined twin through their research and selected a few specific types of conjoined twins to focus on in the presentation. The following presentation outline was generated and recorded in the Google Docs page (Figure 7.2).

1. Introduction + Embryology (mention Siamese twins)
2. Thoracopagic - Jane + C.S3
3. Parapagus – C.S1 + Caleb
4. Craniopagic – C.S2 and C.S4
5. Prognosis

Figure 7.2. Group C presentation outline (GD.C.101-104)

As the group developed this presentation outline, they considered their own interests, the research question, and the amount of information available. Consideration was given to students’ own interests in selecting both what types of twins they would highlight throughout the presentation and who would continue to research and develop each segment of the presentation.
For example, C.S2 expressed interest in craniopagic twins stating, “so if nobody minds I can look into that one” (FM3.C. 583). Jane stated, “I sort of like the thoracopagic” (FM3.C. 615) and so selected that section of the presentation to research and develop. Other students in the group went on to make their selections in much of the same way as C.S2 and Jane.

Further, the group used their Inquiry Question as a guide in shaping their presentation outline. For example, as the group discussed whether or not they should conclude their presentation with a discussion regarding the prognosis of conjoined twins (i.e., their likelihood of survival), C.S3. pointed out that such a discussion would help to “wrap things up” (FM3. C. 584) by answering the initial Inquiry Question set forth as to whether or not conjoined twins are able to survive given their anatomy and how they manage everyday life.

Finally, students considered the amount of information available on each type of twin so that they could be confident that there would be enough information to devote an entire section of their presentation to that type of twin. For example, craniopagus twins were included in the presentation outline because C.S4 expressed confidence with the amount of material available: C.S4, “I did most of the research for the craniopagus [twins] and there is just so much you can talk about” (FM3.C. 380-381).

Presentation development. In addition to updating FC on the progress of their work, the third facilitated meeting served as an opportunity for the group to develop their presentation further. FC initiated the conversation about the presentation by saying:

You guys seem like you have a good idea in terms of how you would like to present, what sort of things do you think the audience will be appealed to in addition to the actual project topic itself? Like what sorts of things would you do to capture your audience’s attention? (FM3.C. 702-710)

In response to FC’s questions, group members discussed ideas for their presentation that would highlight their overall Inquiry Question of how conjoined twins live their daily lives.
through one body. For example, C.S1 suggested that the presentation tell the stories of conjoined twins and how they live: “Because [the conjoined twins] are people, [our presentation] can be told be told like a story, like so-and-so and so-and-so lived until blah-blah-blah” (FM3.C. 919-920).

Throughout their research, the group had come across numerous case study examples (i.e., case examples of each type of conjoined twin they were investigating). Jane and C.S3 proposed that video clips highlighting these case studies could be incorporated into the presentation to demonstrate how various conjoined twins engaged in daily activities of living. The group agreed that video clips would likely resonate with their classmates:

C.S3: [video clips will] take [the audience] beyond the theoretical and show them that these [conjoined twins] are actual people. Because a lot of people in Life Sci are thinking about Med School so it helps make the connection that this is not just theoretical that they’re living breathing people who have lives. (FM3.C. 711-714)

Following the third facilitated meeting, further thought was given to how the students might be creative with their presentation. C.S1 developed a Prezi presentation, then, during the third in-class work period on March 25th, the students came up with an idea to incorporate a theme based on the television show The Magic School Bus into their presentation. When later asked how the group came to this theme, Jane explained:

We were trying to be creative – because they kept telling us to be creative […] We liked [The Magic School Bus] because it’s sort of how all of us I think when we were younger, how we learned things that we were interested in – and especially like stuff about anatomy, because I think the episode that all of us thought of was one where they like jump inside somebody’s body and looked at the different systems so we sort of wanted to continue that idea. You hear the Magic School Bus theme, and it’s like ‘oh I am going to learn something that’s going to be fun’. So we decided to go with that. (I3.Jane. 46, 52-58)
In his interview, Caleb also spoke about the *Magic School Bus* theme and the meaning that it held for him and his group mates:

I think we were all in agreement that like, in the *Magic School Bus* the kids would just be put in environments that they don’t really know. Like they just look at these new things and they discover these things and then Ms. Frizzle explains them later. So it’s like discover first, explain later. It’s just a lot of exploration, which is basically what we are doing. (I3.Caleb. 515-518)

During an informal and unfacilitated meeting that was observed on March 25th, 2013, the group worked within their pairs to refine their respective sections of the presentation and incorporate the *Magic School Bus* theme into their presentation plans. As a result of this work, their theme developed further:

C.S4: “With the *Magic School Bus* thing how are we going to make all the characters have lines because little kids don’t know anything about this. It will be Ms. Frizzle with the research”.

Jane: “We could have them doing like what we learned today. The intro could be this was our field trip and this is what they found”.

Others agree.

C.S4: “At the beginning it can be like ‘ok you have done your project on conjoined twins, let’s go see them’”.

Jane and S1 both say “yea”.

C.S3: “Or it could be a class reunion at university. Like ‘hey we are going to on one more trip guys”’. The girls laugh.

C.S1: “*Magic School Bus* university style!”

Jane: “Yes!”

S4: “They all went into anatomy when they grew up”.

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Jane: “That’s so perfect”. (UFM1.C. 122-144)

During the fourth facilitated meeting, the group spent their time composing a script for their presentation that further incorporated The Magic School Bus theme into the presentation. Under some guidance from FC, the students used their theme to develop a storyline to compose an introduction and link each section of their presentation together. For example, the following observation was made:

FC: “How do you want to transition from one type [of conjoined twin] to another type [of conjoined twin]?”

Multiple people talk – C.S1, Caleb, and Jane. They suggest that they will get on the bus and ‘travel’ to the next case.

Jane: “We can just say ‘great job! Now let’s go visit this set of twins’.

C.S1: “and then we can use the sound of the bus, beep beep”. (FM4.C. 455-462)

To collaboratively author this script, students worked within a Google Docs page. Each student worked at his or her personal laptop to add to the developing script, allowing other students to see changes as they were made to the document.

Presentation. On April 2nd, 2013 the group gave their presentation to a room filled with 18 other students from the Anatomy Course, FC, and Prof. At the time of the presentation, the group presented the Inquiry Question of: “How can two people live in one body, like in the case of conjoined twins?” (GDO2.C. 13-15). As the presentation ensued, the group following in the storyline of their Magic School Bus theme where Magic School Bus students (C.S2, C.S3, C.S4, Caleb, and Jane) reunited with their teacher, Ms. Frizzle (C.S1) for a university-level Magic School Bus field trip (Figure 1).
During the field trip they visited three sets of conjoined twins in their hometown to explore how the twins lived their daily lives. Using the magic powers of the *Magic School Bus*, the group went inside the twins’ bodies to demonstrate how their anatomy allowed them to live and function as two bodies in one. Each section of the presentation was presented mainly by those students who had focused their research on the type of twin being highlighted in that section. However, the students had prepared their script so that each student participated in each section of the presentation despite their area of research. The following is an excerpt of their presentation:

C.S1: “We know that each twin controls her own respective side of the body. What can you tell me about the nature of the motor and sensory pathways?”

Caleb: “Well we know that it’s of a contralateral arrangement, so that must mean that one twin is controlling the side using the opposite side of her brain”.

C.S3: “According to my research, that side of the brain would be expected to be more developed. What does this mean?”

Caleb: “If I recall correctly, the right-sided brain is more involved with creativity and language, whereas the left-sided brain is more involved in systematic and logical. And we know that Brittany is on the left side, that must mean she uses her right side of the brain.”
which could possibly explain why she has a greater tendency towards words, creativity, and language! The same applies to [Abby], who uses the opposite side and has a tendency towards math!” (Pres.C. 3:21-4:10)

The presentation ended with a question and answer period where audience members were given the opportunity to ask the group questions. One audience member asked, “For the twins that are connected through their brain, is it possible that one could survive if the other died?” (Pres.C. 16:47-16:59). In response to this question, three of the six students from the group offered their input. Each responding student appeared to draw on the generalized knowledge they had developed throughout the project. For example, C.S4 (who had been responsible for investigating the musculoskeletal systems of conjoined twins and craniopagus twins) said, “There have been examples. It depends on the degree of connection. So there have been examples of separation. For example, I think the MRI that we showed – they were separated and one of them did die after the surgery and one lived” (Pres.C. 17:03-17:15). While C.S1 (who had been responsible for investigating the embryological basis of conjoined twins and parapagus twins) added, “In doing our research we came across a lot of cases where they would be born and one twin might survive and the other would die and they would have to be separated, and the one that survived would survive still” (Pres.C. 17:46-18:25). In responding the audience member’s question, students drew more upon generalized knowledge of conjoined twins as developed through collective research efforts than their specific areas of focus, demonstrating the integrated knowledge developed of the topic as a whole.

Overall, the group was successful with their presentation and project as a whole. FC was responsible for evaluating the group on the Group Process and Presentation components of the project. She gave the students a score of 23.5/25 on the Group Process component and a score of 23.5/25 on the Presentation component. In an interview conducted at the end of the term, FC commented on why she had graded Group B the way she had. In regards to the group process
mark, FC explained that she had based the mark on the way that the group had continually shown enthusiasm, and noted that “[she] could also see how they kind of divided up the work evenly” (I.FC. 292-293). In regards to the presentation, FC commented, “I thought their presentation was really good. It was something that was really anatomically focused which is kind of the point of the project and they did a really good job in terms of making it really easy to relate because they looked at case studies” (I.FC. 313-316). FC noted that the only area of weakness with their presentation was that “they did like look at their script quite a bit” (I.FC. 321) and could have worked on speaking more directly to the audience.

**Experiences during the Inquiry Process**

Caleb and Jane’s participation in the interview component of this study allowed them to reflect and comment on their experiences throughout their engagement with the project. In this section, the results of these individual experiences are presented.

**Caleb’s experiences.** During the Inquiry Project Caleb was observed during facilitated and unfacilitated work periods. Further, Caleb participated in a second interview conducted approximately half way through the project on March 1st, 2013. The following three themes emerged of Caleb’s experiences.

*Quiet participation in collaborative and distributed work.* Based on past experiences, Caleb had a negative attitude towards group work. He explained: “I’ve taken a lot of lab courses where people tend to have like no initiative whatsoever” (I2.Caleb. 170-171). In the past, He felt his colleagues had “not really [been] inclined towards learning or inclined towards group work or democracy or diplomacy or anything of that, they are just after the grade” (I2.Caleb. 939-940). Under these conditions, Caleb had felt pressured to take on roles he wasn’t comfortable with: “I don’t like always being the one with initiative because I have a lot of things to do – I mean I hate being like the cheerleader sort of thing” (I2.Caleb. 172-173). His experience in working with Group C, however, was different. He enjoyed working with his group and felt a sense of
camaraderie with his peers: “we are all in this together like we sort of understand what is going on and we have all been in anatomy so like, again like we all have the same knowledge” (I2.Caleb. 974-976).

Caleb had two reasons why this group work experience was so positively different from the past. First, he felt the assessment structure of the Inquiry Project fostered both group and individual contribution. In previous group work experiences, “we are all given the same grade” (I2.Caleb. 932) so people would “snap at others or lash out at others” (I2.Caleb. 933) if there was a risk of poor performance. However, with the Inquiry Project “each person will assess himself, and his group mates will assess him so you will have like your individual assessment from everyone. There’s no way that justice will not be done for each person” (I2.Caleb. 943-946).

Second, Caleb no longer felt he was the only one with initiative and motivation. For example, he said:

Generally everybody in the group is really active, I would say and everybody is coming up with ideas and contacting each other and like every time we meet we discuss like our ideas and … it’s a pretty active process I’d say, […] it’s pretty great. (I2.Caleb. 44-47)

Being within a group of likeminded and motivated peers, Caleb felt the work was better distributed. In this environment, he didn’t have to act as the group “cheerleader” (I2. Caleb. 173) and instead could perform those roles and tasks he was more comfortable with. Caleb preferred to focus on the research and scholarship responsibilities of the project and took these on as his main contribution to the group. While others regularly engaged in conversation with one another about the brainstorming and creative aspects of the project, Caleb tended to go with the flow, quietly listening to the conversation and rarely opposing suggestions or decisions made by the others. He often spent facilitated meeting time researching independently on his laptop, he set up a Google Documents page where group members could keep track of and share their research, and
encouraged others to use a range of online resources to find scholarly sources of information. These responsibilities seemed to better align with Caleb’s quiet, methodical personality.

**Revisiting anatomy material and deepened learning.** Caleb’s initial intentions as expressed at the outset of the course (to learn new things and apply his understanding of the human body to daily activities) were being supported through his engagement with the work. The Inquiry topic selected by Group C afforded the group an opportunity to revisit material they had previously learned in the Anatomy Course:

> With regard to our project we are talking about the lymphatic system, the digestive system, the respiratory system, the nervous system… like everything that we’ve actually covered so like I feel like going through all that again, we will fine tune our knowledge of it. (I2.Caleb. 908-915)

In addition to achieving his initial goals for the course, the Inquiry Project was facilitating Caleb to learn in other ways. The project was not only reinforcing the anatomy content but life skills and new learning habits as well. He said, “the best thing I will get from anatomy probably isn’t like the information itself, like about the systems, like probably developing my learning habits because like it’s through anatomy I have learned to study for so many things in so many different ways” (I2.Caleb.880-883). In addition to developing new learning habits, Caleb also felt he had developed group work skills that would be applicable to the future.

**Jane’s experiences.** Jane was observed alongside other group members of Group C and participated in a second interview on March 1st, 2013. Analysis of the data collected from these sources produced the following themes of her experiences as she was engaged in the project.

**Growing motivation and interest.** As the group delved into assigning individual areas for research, Jane was feeling highly motivated and interested in the project. Jane felt her motivation growing as the project ensued:
At the beginning of the project I guess I was more skeptical of the purpose of it and kind of confused about what we were doing. But now, whether or not we’ve got exactly what we are doing or doing it right, at least everybody’s sort of motivated and working on this. Like everybody has something that they are passionate about so yea, I’d say I’m a little bit more motivated now then at the beginning just because every time somebody has a really interesting fact that they’re excited to post on the group or something, it sort of makes you want to find something that will get everybody excited as well. (I2.Jane. 474-481)

Of particular interest to Jane were the stories about the different conjoined twins and how they lived everyday life given their anatomical bodies. She was interested in how she could draw on modern medical research to explain historical cases of conjoined twins:

I can sort of find research now that explains [a historical case] or like I can look at the case and be like I know why that might have happened or like how like their systems might have been working – so just sort of putting the pieces together from a general story is kind of I guess what’s been inspiring me. (I2.Jane. 428-431)

Overall, Jane’s motivation and curiosity for the project thrived as she found clarity on project’s expectations and interest in the research as the project developed.

“It’s ok to speculate”. Before the project began, Jane understood the project to be an opportunity to draw upon research and determine significant information for answering a research question. Yet as the project commenced, Jane was uncomfortable with the lack of guidance being offered of the process. For example, in the first facilitated meeting Jane asked FC if she would provide the group with an example of an acceptable Inquiry Question. When FC refused saying, “I don’t want that to interfere with your creativity” (FM1.C. 581) Jane replied, “There’s too much creativity right now” (FM1.C. 583). By way of this example, it appeared that Jane wanted more guidance and instruction than FC was willing to offer.
As Group C selected their topic and began their research process, however, Jane began to develop a stronger understanding of what it meant to engage in this investigation. Jane reflected, “I guess the purpose [of the Inquiry Project] is just to sort of look at this mystery that we don’t really understand” (I2.Jane. 173-174). The group was using “what we know to understand other people’s research” (I2.Jane. 175-176) and by engaging in this process “we’ve learned that it is sort of ok to speculate and take somebody else’s research and apply it to [our question]” (I2.Jane. 178-179). Real research must start with an outstanding question that is then informed by the research work of others. This was a revelation to Jane because, as she explained, she had never engaged in research work where the answer wasn’t already well known to her and her instructors:

All we have ever done is research for like a lab or like a paper where we know what the answer is supposed to be and the TA knows what the answer’s supposed to be so we are just fitting in other people’s research to support what we already know but this is probably more accurate, like more accurate representation of what real research is, is where you know what somebody else found and you have something that’s sort of similar so you’re, I guess seeing if it applies but you don’t know, which is new because usually we know the answer. (I2.Jane. 187-194)

Later on, when other students from Group C were also struggling with the lack of guidance, Jane encouraged her group mates to engage in academic speculation. During the group’s unfacilitated meeting time on March 25th, the group was discussing different examples of conjoined twins. Each case example varied in the amount of information available. When the group decided that they wanted to present a case example for which they did not have complete information available through direct sources, the following conversation ensued:

S4: “Is there stuff that you could infer from what is known about Abby and Britney?”
S1: “I think we can infer a lot about Abby and Britney. I am not sure if we are allowed to do that.”
Jane: “I feel like it sort of goes with the idea of the project though maybe. Like taking… I don’t know I feel like you are taking the information from that and applying it”.

S1, “Right, is that what we are supposed to do? I don’t know”

Jane: “I say yes”. (UFM1.C. 333-343)

Overall, as Jane engaged in the Inquiry Project her understandings of research, speculation, and inference changed. She developed a level of comfort with the process of applying her knowledge in new ways – so much so that she had the confidence to encourage group members to do the same.

**Peer Evaluation Component**

The peer evaluation component of the project required the group to design a rubric that each student would then use at the end of the project to evaluate his or her other group mates. At the beginning of the project, Group C students had worked together to design a peer evaluation rubric. This initial work had been stimulated by FC during the first facilitated meeting when she asked: “What kind of things you want to see in your other group members and what you think is important in terms of… like what would be a good characteristic or things that a good member would do or should do?” (FM1.C. 373-376)

While they had spent some of their first facilitated meeting and first in-class period working on the rubric together in person, they completed the work remotely via a Google Docs page that allowed each member to contribute to the collaboratively written document. The resulting rubric is displayed in Table 7.3.
Table 7.3.

*Group C’s Peer Evaluation Rubric (GD.C.62)*

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<thead>
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<th>Criterion</th>
<th>Excellent Attempt</th>
<th>Good Attempt</th>
<th>Average Attempt</th>
<th>Weak Attempt</th>
<th>No Attempt</th>
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<tr>
<td>Positive attitude, always willing to</td>
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<tr>
<td>lend group mates help when needed,</td>
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<tr>
<td>prioritizes the group’s interests.</td>
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At the end of the project, each student used this rubric to evaluate each of the other group members. They then submitted their completed rubrics to FC who used the scores to calculate a peer evaluation mark for each group member by averaging the scores given to each person from his or her peers. Students rated each other very positively. Each student received a perfect score of 25/25. Students also wrote qualitative comments about their group members, further illustrating their positive opinions. For example, Caleb wrote comments such as: “[C.S4] made an excellent contribution to our group. She inspired the concept of our question […] and was always very positive and enthusiastic” (PG3.Caleb.), “[C.S3] was an integral member of our team” (PG3.Caleb.), and “[C.S1] was ambitious and extremely creative” (PG3.Caleb.).
**Personal Goals Component**

As previously described, each student was expected to set a personal goal for themselves at the outset of the Inquiry Project and devise an action plan for making progress on the goal over the length of the project. They were required to submit three reflections in an effort to describe their goal, provide evidence of progress, and reflect on their experiences. Table 7.4 provides a summary of each student’s goal, their rationale for selecting it, and an example of the success they claimed to have made across the term.
Table 7.4.

**Summary of Group C’s Personal Goals**

<table>
<thead>
<tr>
<th>Student</th>
<th>Goal</th>
<th>Rationale</th>
<th>Evidence of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.S1</td>
<td>Minimize stress</td>
<td>Stress and anxiety with regards to assessment in school, particularly [the Anatomy Course] where there are multiple evaluations per semester, has begun to dominate my daily life. As I don’t believe this is healthy, improving upon this aspect of my educational experience appeared to be a more pertinent goal (PG2.C.S1. 7-11)</td>
<td>After having spent this semester working on my personal goal I feel that I have improved significantly in this area. While I cannot say that the actions I have taken have left me feeling stress-free all the time, the intention to try my best to keep my stress levels as low as possible has made an impact in itself. (PG3.C.S1. 1-5)</td>
</tr>
<tr>
<td>C.S2</td>
<td>Improve time management skills</td>
<td>This goal is important to me because right now, even though I try not to, I always somehow end up procrastinating, and it is alarming how stressful it can be (PG1.C.S2, 5-7)</td>
<td>Overall, at this point, I am quite satisfied with my personal goal. […] Through this project I have learned a number of things about myself. The biggest thing I have learned about myself is that a schedule helps me out immensely (PG3.C.S2, 53-54, 66-67)</td>
</tr>
<tr>
<td>C.S3</td>
<td>Communicate more effectively</td>
<td>This goal is important to me because many times I am not able to get my ideas across coherently and therefore time is waste and or my group members do not understand what my ideas are. (PG1.C.S3. 1-3)</td>
<td>I have made progress but realize that there is so much that can be done. I also realize that this has huge benefits in both my academic and career ventures whether though giving better seminar presentations or being able to interview better. (PG3.C.S3, 101-105)</td>
</tr>
<tr>
<td>C.S4</td>
<td>Become better at organizing and utilizing time</td>
<td>Although I am a hard worker, I find that I can be easily distracted and often become unorganized. (PG1.C.S4, 2-3)</td>
<td>In general, reflecting on my progression over the weeks of the [Inquiry Project], I am happy with the results I have seen. I feel like I have made steps towards improving my time management skills and have definitely seen improvement in my organizational skills (PG3.C.S4, 79-82)</td>
</tr>
<tr>
<td>Caleb</td>
<td>Time management</td>
<td>Time management has been something that I’ve forced on myself in second year as my schedule is atrociously tight. I’ve done this by myself and feel like if I work with my group mates, organizing the project together and developing our time management together, this skill is bound to grow. (PG1.C.Caleb. 30-32)</td>
<td>I have definitely become more aware of myself when I’m procrastinating and I immediately think back to my personal goal and, strangely enough, I easily force myself to dismiss distractions and delve back into work. (PG3.C.Caleb. 90-93)</td>
</tr>
<tr>
<td>Jane</td>
<td>Improve productivity though time management</td>
<td>The stress of keeping up with work and due dates, while still maintaining a wide array of extracurricular activities takes its toll (PG1.C.Jane, 1-4)</td>
<td>In the course of this project, I strengthened my communication skills for presentation and was reminded of the importance of time management, especially in the context of a group project. (PG3.C.Jane, 2-5)</td>
</tr>
</tbody>
</table>
While each student’s goal was unique, common themes included goals that focused on time management and feelings of stress. All six appeared to draw on their experiences as students, their self-identified struggles, and skills related to the Inquiry Project. For example, C.S1 felt stressed due to the multiple examinations and assessments required of her through her studies. C.S2 regularly procrastinated with her schoolwork. C.S3 felt he struggled to communicate his ideas and thoughts to others. Students also recognized the value their goal would have beyond the Anatomy Course – either in application to other courses or future endeavors. For example, C.S3 thought the advancements he had made on his goals would have “huge benefits in both [his] academic and career ventures” (PG3.CS3. 103).

During each facilitated meeting, FC facilitated a discussion of the personal goals component asking each person to speak about their personal goal to explain their approach and progress to the others in the group. Of all three groups followed by this research study, Group C was the only group who was facilitated to speak of their personal goals in this manner. Groups A and B were never asked by their facilitators to discuss the personal goals in their facilitated meetings.

Since Caleb and Jane could elaborate on the personal goal component of the project through their participation in interviews, an in depth perspective on their experiences of engaging in such a task is discussed next.

**Caleb’s personal goal.** At the outset of the personal goals component of the project, Caleb figured he would “make something up” (I3.Caleb. 660). Despite instructions to set one personal goal and outline an action plan for achieving it using the SMART criteria, Caleb’s first reflection was philosophical, unfocused, and lacking an action plan. He wrote:

> Personally, I have one encompassing goal in life: success. This isn’t the fantasy-like goal that typical American Idol participants flaunt about. I don’t hope to succeed as the king of
the universe or anything of the sort […] Success is not typically a goal, but an ultimate product of a series of goals set to reach this point. (PG1.Caleb 3-5, 8-9)

He reflected on communication, organization, time management, perseverance, and research skills, but failed to set a clear goal or action plan upon any of these elements – as was expected of the assignment. Upon reading his reflection Caleb’s facilitator, FC, suggested that Caleb select one personal goal to focus on and use the SMART criteria (specific, measurable, attainable, realistic, and time-bound) to devise an action plan. With this, Caleb chose to focus on time management. Yet at this point, Caleb was still of the attitude that he would make something up – an attitude that began to change the more he worked at his proposed action plan. In describing his thought process at the time Caleb said, “I was like, I will have a calendar and I will just write things down on it but I ended up…I was like ok I might as well like write real things down to help see my week. Like it actually helps” (I3. Caleb. 660-662).

For the remainder of the project, Caleb tracked the use of his time by recording daily activities on a calendar. He felt the activity “sub-consciously forced [him] to better [his] time management” (I3. Caleb. 676-677). In his final reflection, Caleb reflected on both positive and negative lessons he had learned about himself. For example, he recognized that he worked best with a busy but organized schedule, and that setting up rewards for himself helped him to stay motivated and on task, yet he also learned that his stressful school schedule was negatively impacting his health with his lack of sleep and exercise.

Jane’s personal goal. As a second year undergraduate student, Jane was feeling “unbelievably stressed and anxious” (PG3.Jane. 5-6). For the personal goal component of the course, Jane thought that if she could work on improving her productivity through focusing on time management she could reduce her feelings of stress and anxiety. She explained:

I find that if I put stuff off I end up getting really stressed and then my work is not of very good quality so I am going to try and improve the quality of my work by managing my
time better and making sure that I am doing stuff ahead of time and also so that I can get help when I need it. (FM2.C. 88-91)

To act on this goal, Jane set out to compile due dates into one location, set a “to-do list” everyday, evaluate herself at the end of each day to track her success in sticking to her plans, and to “get help when necessary and use all available resources” (PG1.Jane. 15).

Figure 7.4. Jane’s personal goal data. Documented schedule and reflection. (PG2.110-128)

Figure 7.4 shows an example of the way in which Jane structured her schedule and reflected on her progress. As demonstrated in the written reflection above, Jane’s personal goal was not limited to the Inquiry Project – she was applying her approach to her entire academic and extra-curricular schedule and observed improvements to her work in each of these areas.

Jane continued to actively manage her time throughout the remainder the term. She regularly talked about her goal with her group mates who would recommend different approaches. Through borrowing these ideas and trying them out, Jane said she had developed “a growing artillery of scheduling and stress-management tools” (PG3.Jane. 19-20) such as keeping
a monthly calendar, setting daily goals, writing weekly reflections, and seeking out campus resources including academic advisors and student tutors.

By the end of the project, Jan felt she had learned a great deal about her “learning and self-management tendencies” (PG3.Jane. 43) through the personal goals component. She thought the skills she had developed would be applicable to a variety of future activities including “choosing courses, tutors and job opportunities in the future” (PG3.Jane. 46-47).

Overall Experiences and Reflections after Inquiry

After the Inquiry Project was complete, I met with Caleb and Jane each individually for one final interview. During these interviews, the students reflected on their experiences of the Inquiry Project as a whole. Analysis of these interviews revealed overall themes of Carlos and Jane’s experiences. In addition to student interviews, an interview was conducted with FC to collect her reflections on her experiences and observations as a facilitator. Analysis of these interviews revealed overall themes of such experiences and are presented in the remainder of this section.

Caleb’s experiences. The interview with Caleb was conducted on April 20th, 2013 and two themes emerged of Caleb’s experiences overall.

Inquiry as a positive experience of working with others. The project was an overall positive experience for Caleb of working with his group mates. His group was “really friendly and close” (I3.Caleb.878) and they worked well together – sharing the responsibilities equally and trusting one another with the work. Towards the end of the project Caleb didn’t feel stressed or nervous because he felt “rest assured that like my group would do their parts” (I3.Caleb. 706-709). Overall, the project felt more like a social activity to Caleb than an academic one, “which is great because like we don’t really get that opportunity anymore” (I3.Caleb. 348). The overall purpose of the project for Caleb had been to develop skills in working with others. This was
valuable because, “group work is important in every aspect of like the future” (I3.Caleb. 608-607).

**Frustration at FC’s guidance.** Caleb was negative and frustrated about the personal goals component of the project and the guidance he received from FC. While the activity had been valuable, it didn’t seem to be an appropriate fit for an anatomy course, “I feel like it’s anatomy and not like ethics or philosophy or like a life management course” (I3.Caleb. 181-182). FC had been too critical of his written reflections, “FC was like really scrutinizing” (I3.Caleb. 216). For FC to pass judgment on personal goals felt counterintuitive to an inquiry-based approach: “I would write something and she would like ‘yea, I don’t think this is a personal goal’ and I don’t see how that works because if you are having students write something that is so personal how could you be able to like, like how could you grade that?” (I3.Caleb. 216-219).

Despite successful performance on both the personal goals component and project overall, and despite recognizing the improvements made by working on the personal goal component, Caleb was frustrated at the activity, “personally I just wanted to get that out that like, I hate the reflection part (laughs) that’s pretty much it” (I3.Caleb. 824-825).

**Jane’s experiences.** The interview with Jane was conducted on April 9th, 2013 and three themes emerged of Jane’s experiences overall.

**Feeling part of a collective.** Overall, Jane felt a sense of belonging to her group. She was motivated by “the idea of working with a group because we don’t usually get to do that. I liked being able to all work together towards one common goal instead of all of us doing our own individual thing” (I3.Jane. 426-428). The project had been a “good reminder of how to work in a group and really share the work” (I3.Jane.332).

Her language around the group’s activities further emphasized Jane’s sense of belonging as she regularly referred to the group as a whole. For example, “We ended up with three types that we thought were the most interesting and then we sort of continued from there and worked in
our pairs to come up with the presentation” (I3.Jane. 35-37) and “I think we were all happy with [the presentation] in the end just because everything went the way we wanted it to” (I3.Jane. 216-217).

**Inquiry as different from the norm.** Jane enjoyed working with her group because her learning felt different to her in comparison to her other experiences of learning at the university level. She said, “Everything else we work on its either you share the work with somebody or it’s still an individual project but it was kind of nice just to come back to the original idea of completely working together as a group” (I3.Jane. 333-336).

Not only was the Inquiry Project was “a really nice break from the norm” (I3.Jane. 522-523) in the way that it fostered group work, but Jane felt it was different in other ways as well. First, it offered a “different style of evaluation” (I3.Jane. 348). Jane had never experienced evaluation components such as the peer evaluation, the personal goals, and the presentation in any other course at the university level. In comparing the Inquiry Project to other learning experiences, Jane said, “it is not really similar to anything […] that’s why I like it because it is sort of a different way to learn” (I2.Jane. 583-584, 586-587). Second, the project was “a good chance to take what we were learning and apply it to something that we were interested in” (I3.Jane. 526-527). This experience of learning is demonstrated through the following example:

There were times when we were trying to figure out the muscles and what muscles would have been cut or like reattached when they were separated, that was one where I had to like look through my old notes and see what it was, so it definitely did sort of bring back the content that we had learned and just being like probably we understood what was going on in these different bodies, so I think it definitely did relate to the stuff that we learned. (I3.Jane. 362-368)
The Inquiry Project was an opportunity to revisit the material as covered in the Anatomy Course curriculum but in a new and applicable way so that the students could problem-solve and manipulate the knowledge in new ways.

**Frustration at FC’s facilitation.** Similar to Caleb’s experience, Jane was also frustrated at the personal goals component and FC’s leadership overall. Jane felt she had learned a lot about herself by engaging in the personal goals component but expressed two major concerns. First, the Inquiry Project itself was only worth 15% of their overall grade and, “a lot of the small amount that [the Inquiry Project] was worth came from these [personal] reflections” (I3.Jane. 350-351). With so many other academic responsibilities, the amount of work required of the personal goals didn’t match its value in grades. Second, Jane thought FC had placed too much emphasis on the personal goals component, so much so that it didn’t seem to fit well with the rest of the Inquiry Project: “I think the emphasis on the reflections and personal goal seemed a little bit too much just for the idea of the project” (I3.Jane. 552-553). Jane sensed that the expectations and guidelines had “varied from facilitator to facilitator” (I3.Jane. 557) so that there was little consistency between groups.

Jane expressed further frustration at her facilitator, FC, whom she felt was too vague with her guidance and evaluation. In regards to FC’s guidance, Jane told the following story:

There were a couple of things that we proposed and because there hadn’t been too much feedback or many guidelines at the beginning we had just gone for it. Even the idea of doing conjoined twins – when we first asked what kind of topic we should be looking for she couldn’t give us any examples or anything so we just sort of launched into this one. Then she told us that another group might be doing [the same topic] and we were like ‘oh but… is that the whole topic or can we ask a different question?’ but then there was sort of no answer to that so… I don’t know, I guess just trying to figure out what exactly she
was saying it was sort of like a code (laughs) like you are not allowed to tell us this but you kind of are so I don’t know. (I3.Jane. 476-490)

In the same way that FC seemed secretive about her guidance, FC had not been transparent enough about how she was evaluating them: “Overall with the project – I liked the idea of it being really self-directed and that we were sort of free to investigate, but the thing is we are being marked by some rubric (laughs) so, yea, I guess, a little bit more guidance would have been nice” (I3.Jane. 453-455).

**FC’s experiences.** FC was interviewed on April 4\(^{th}\), 2013. Three themes arose of FA’s role, experiences, and observations arose through analysis of the interview transcript.

**Not wanting to interfere.** This was FC’s second time serving as a facilitator for the Inquiry Project. As a result, FC described feeling a strong sense of her role and her approach to facilitating at the outset of the term. She saw herself as a mentor, as “someone to let the students know if they are on the right track or not” (I.FC. 112). As a facilitator of the previous season, FC had “tried not to interfere into [the group’s] discussion or tried not to say ‘oh I really like that idea’” (I.FC. 115-116) for fear of steering them in a particular direction or influencing the project with her opinions. FC conveyed her role and her approach to Group C by saying:

> My role here is to more so to guide everyone in the project on to the right track so I’m the person that would kind of make sure people have their goals submitted […] [The Inquiry Project is] a different way of learning so I’m here to support you guys in that sense.

(FM1.C. 86-88, 91-92)

Drawing on her approach from the year before, FC explained her approach to facilitation and her desire not to interfere with the group’s ideas:

> A lot of times I will try to answer your questions with a question, rather than just telling you guys an answer because the group is all about you guys, its about what you guys want to get out of it and its also for you guys to think about the questions and answers for
yourself rather than just getting answers straight off the bat so that’s how I will work as a facilitator. And by no means should you guys have to ask me ‘Oh is this a good idea?’ It should be more so like what you think is best and whether you guys think it is a good idea or not. So that’s sort of how inquiry works. (FM1.C. 88-89)

**FC’s reflections on her facilitation approach.** As previously described, FC initially understood her role as that of a mentor who should let students know “if they are on the right track or not” (I.FC. 113) without imposing her own opinions, interests, or suggestions onto the group. As the project came to an end, FC still firmly believed that “the facilitator isn’t someone who would be like “ok you do this, you do that” (I.FC. 1273), but struggled with achieving the proper balance between mentorship and influence:

I did get feedback saying that ‘I wish that my facilitator gave more of her opinions on certain things’. I just remember certain instances where they asked me like ‘oh do you think his is a good presentation format?’ or ‘do you think it is an interesting topic?’ and I really didn’t want to say ‘yea I think this is great!’ That sort of thing, but I didn’t want to do that because that would sway the group in a different direction than what the group probably wants more so than what I want. (I.FC. 1273-1283)

FC knew that the Inquiry Project was so unstructured that students “really need[ed] a lot of guidance” (I.FC. 133) so that they were uncomfortable when she had answered their questions with responses such as “well what do you think?”. In such instances, FC thought “perhaps [the students] wanted responses that were just like ‘oh I think this is a better idea because…’ whatever it is” (I.FC. 133-141). In light of this struggle, FC thought she should have been more explicit with students about her position. For example, reminding her group throughout the facilitated meetings that she would not be sharing her own opinions in response to their questions.

**Observations of group dynamics.** One of FC’s primary roles was to monitor and evaluate Group C’s progress over time. Therefore, FC’s reflections of her experience were predominated
by the observations she had made of her group. She spoke of the group’s changing motivation over time and about how the students had interacted with one another.

In regards to the group’s changing motivation, FC observed how “they were more outgoing at the end or being more comfortable, but I think they were definitely more engaged in the project” (I.FC. 362-364). Initially she thought that students likely perceived the project as a requirement of the course that simply had to be done. Over time, however, FC observed a “change in passion” (I.FC. 370) where students had developed an “interest to learn about the conjoined twins and actually communicate that properly” (I.FC. 367-368).

In regards to the observations she made of students’ interactions, FC noted each student’s demeanor, making comparisons between members. For example, she described Jane as “the energizer because she was always really excited” (I.FC. 636), and described Caleb and C.S2 as “the ones who were more quiet” (I.FC. 658) in comparison to C.S3, C.S1, Jane and that C.S4 tended to speak out more. FC had also paid attention to the way in which group members worked with one another. She thought that the group had “worked well in the sense that they really capitalized on S3, S1, Jane and S4’s abilities” but thought that “if they kind of reached out more asking like if Caleb and S2 had other ideas that they could contribute I am sure they have really good ideas” (I.FC. 663-666). Despite this, the project had been a group effort: “they were definitely considerate, they were definitely sensitive to what other people wanted to do and they weren’t over powering of other people in the sense that they were just assigning people like ‘you should do this’ sort of thing. (I.FC. 695-698).

In addition to being a facilitator for Group C, FC also served as a facilitator for two other groups who were not included in the research study. From this position, FC was able to make comparisons between Group C and her other groups. She thought Group C had been more friendly to one another than her other groups had been. “I found in Group C they were able to compromise pretty easily” (I.FC. 1094), she said, in comparison to other groups where there had
been conflict and disagreement. While she thought Group C had been more eager about the project at its outset, she judged her other groups to be more successful at the project in terms of their idea development and research.

**Chapter Summary**

This chapter focused on Group C. Overall, Group C successfully completed the Inquiry Project. They selected a topic after being inspired by a TLC television program focusing on a case example of conjoined twins. Their initial Inquiry Question was: How do these conjoined twins function as opposed to regular people who are not conjoined? After initial research, the group expanded their topic to investigate the anatomical design of various types of twins to ask: How is it possible for two people to live in one body? The group then selected three types of twins and a case study example of each to focus on during their presentation. They continued to research and develop three respective sections of their presentation in pairs. Finally, the group worked to incorporate a *Magic School Bus* theme into their presentation. Drawing on this theme, the group’s presentation was performed to an audience of other anatomy students, their facilitator, and Prof. The presentation was in the form of a skit where the students of the *Magic School Bus* went on a field trip to visit each case study example and travel inside the twins’ bodies and explore their anatomical design. Through their field trip the students addressed the Inquiry Question: How can two people live in one body, like in the case of conjoined twins?

FC, who served as the group’s facilitator, considered her role to be that of a mentor but struggled with how to respond to students’ needs without too much influence. She observed the group’s work, noting that they were considerate of each other’s personalities and drew on one another’s strengths. As a result of their engagement, FC thought the students had developed a passion for their topic and for sharing their research with others.

Two students – Caleb and Jane – participated in the interview component of the study to share their experiences as students of the project. At the outset of the project, both students had a
positive outlook on the project despite feeling as though they had a limited understanding of its expectations. Caleb described the project as having a mystique about it while Jane said she wasn’t exactly sure what the project was all about. However, Caleb was confident he had the research skills to navigate the project while Jane thought it would be an interesting and different way to learn. As the project ensued, both Caleb and Jane developed an interest in the group’s inquiry topic and their research activities. Caleb felt the project was enabling him to revisit the anatomy material he had learned in class in new and applicable ways. Jane was intrigued by the case studies they were exploring and enjoyed finding research that helped her form a deeper scientific understanding from the life stories of different twins. Further, Jane came to accept speculation as a necessary and acceptable part of academic research. After the project came to an end, both Caleb and Jane described the project as a positive experience due to the way in which they got to work with their classmates. For Jane, the Inquiry Project had offered her a break from the norm and a different form of evaluation than she was accustomed to. Despite these positive reviews both Jane and Caleb expressed frustration with the personal goals component and FC’s cryptic guidance.

The past three chapters (Chapters 5 to 7) focused on each of the three Inquiry groups (A, B, and C), the process for engagement in various components of the project as well as students’ experiences of learning. Through these chapters, I focused on providing a rich description of the groups and their experiences. In the next chapter, Chapter 8, I describe the common meaningful themes that arose out of an attempt to consolidate this richness into qualitative themes of experience.
Chapter 8

Common Meaningful Themes of Student Experiences

One of two central research questions of this research study was: How do students’ experience their learning of anatomy through an inquiry-based learning curriculum? Related to this question, three subsidiary questions were posed: (1) What are the lived educational experiences of undergraduate students participating in the Inquiry Project? (2) What is the learning experience like for students learning anatomy through Inquiry? and (3) How can students’ experiences be explained or characterized?

Chapters 4 to 7 focused upon the unique stories of each group as well as upon students’ individual experiences throughout the project. These stories aimed at providing a rich description of students’ lived educational experiences as they engaged in the Inquiry Project. This current chapter seeks to culminate such stories to explore common meaningful themes shared between participants at the group and individual levels. In doing so, the studies research questions are addressed as students’ experiences are explained and characterized.

As outlined in Chapter 3 (Methodology and Methods), common meaningful themes were identified through a combination of keyword and NVIVO data analysis, thus allowing for the rich description of students’ lived educational experiences to be consolidated into themes. Appendix L offers a summary of the connections made between participants’ stories (as represented in Chapters 4 to 7) and the common meaningful themes articulated throughout this current chapter.

Common Approaches Taken to the Inquiry Project by the Groups

All three groups participating in this research study engaged in similar activities to complete the Inquiry Project. A comparison of the steps each group took in completing their project (Table 8.1) demonstrates similarities in the overall approaches taken.
Table 8.1.

Comparison of Group A, B, and C’s activities in completing the Inquiry Project

<table>
<thead>
<tr>
<th>Common Approaches Taken</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting Started</td>
<td>Getting Started</td>
<td>Getting Started</td>
<td>Getting Started</td>
</tr>
<tr>
<td>Idea Formation and Initial Research</td>
<td>Organizing Research</td>
<td>Idea Formation</td>
<td>Initial Research and Topic Selection</td>
</tr>
<tr>
<td>Question Formation</td>
<td>Question Formation</td>
<td>Initial Research and Question Formation</td>
<td>Question Formation and Individualized Research</td>
</tr>
<tr>
<td>Division of Work, Continued Research</td>
<td>Distributed Collaborative Work</td>
<td>Presentation Development and In-Depth Research</td>
<td>Adjustments and Continued Individualized Research</td>
</tr>
<tr>
<td>Presentation Development</td>
<td>Presentation Development</td>
<td>Presentation Development</td>
<td>Presentation Development</td>
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<tr>
<td>Presentation Rehearsal</td>
<td>Presentation Rehearsal</td>
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<td>Presentation</td>
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The far left column of Table 8.1 summarizes the common stages taken by the groups in completing the project. Each of these stages is summarized next in further describing the commonalities found between the three groups.

**Getting started.** All three groups got started by brainstorming and sharing topics or questions they were interested in. In all three cases, one or two topics stood out to the groups as particularly interesting from the beginning. For example, in Group A’s first facilitated meeting the topic of Barbie and her body shape elicited excitement. In Group B’s second facilitated meeting, the group was particularly drawn to Heather’s suggestion of investigating the power of the brain’s influence over health. In Group C’s second facilitated meeting, group members told FC that they had quickly become attached to the idea of investigating conjoined twins after watching a TLC video.

**Idea formation and initial research.** In discussing their ideas, group mates shared what they already knew about the topic. For example, members from Group A already knew that
Barbie’s body was not reflective of normal anatomy due to her disproportions. After sharing ideas, group members began to wonder how much information might be available about the topic they were gravitating towards. This curiosity stimulated some members to begin seeking out and assessing just how readily research and literature on the topic might be accessed. For example, while Heather (Group B) wanted to decide on a topic by the end of their second facilitated meeting, her group mates wanted to conduct some initial research before making a final decision. Once a decision had been made, the main topic or question was then broken down into related topic areas. The way in which Group C initially focused on six different organ systems of conjoined twins Abby and Brittney served as one example.

**Division of work and continued research.** Dividing the work into smaller chunks allowed the larger group of six to work more independently of one another. Individuals and/or pairs selected one of the related topic areas to focus upon in researching further. As they researched, members shared their discoveries with their group mates through online mediums such as Google Docs pages and private Facebook groups. After individualized work, groups then reconvened to share and compare what had been found. Such a meeting was either achieved through facilitated or unfacilitated meeting times. While Group A used their third facilitated meeting to discuss such points in person, Group B arranged for a synchronous online chat through Facebook. Through such discussions, group members compared the research they had completed to date so as to make connections and identify outstanding questions.

**Presentation development and rehearsal.** At this point, all three groups – particularly Groups B and C – turned their attention toward developing a presentation outline as a way to organize their continued research efforts. Research goals were sometimes re-framed leading to alteration of the Inquiry Question. For example, Group C changed their focus from one specific set of conjoined twins to three different types of conjoined twins. As a result, their Inquiry Question broadened.
After groups reframed their inquiries, further research work was conducted, but focused more upon the developing presentation than upon open-ended exploration. Students condensed and incorporated their research findings into 2 to 3 minute sections of the presentation that were then integrated together. In all three groups, one group member volunteered to incorporate chunks together in either PowerPoint or Prezi. Through consultation with one another and rehearsal, the groups then edited and refined their presentation in preparation for the presentation day.

**Presentation.** All three groups gave their presentation to an audience of approximately 20 classmates from the Anatomy Course, their facilitator, and Prof. Presentations were done within various campus classrooms, where groups made use of classroom technology such as data projectors, TV screens, and sound systems. A question period followed each of the presentations. All three groups addressed the questions posed to them by drawing upon the integrated knowledge each student had developed throughout the Inquiry Project.

**Common Meaningful Themes of Group Work**

Given that the three groups took similar approaches to engaging in and completing their Inquiry Project, various common and recurrent meaningful themes were found through qualitative data analysis. These themes characterize and explain how groups engaged in the project as a whole. All three groups took similar approaches in the way they (1) constructed knowledge, (2) fostered interests throughout the project, (3) worked together as a group, and (4) expressed themselves creatively. Figure 8.1 visually organizes these themes, which are discussed and elaborated upon in the sub-sections that follow.
Construction of knowledge. The theme of “Construction of Knowledge” relates to how knowledge was formed and created by the Inquiry groups throughout the project. Overall, groups constructed knowledge around three points: (1) students’ interests, (2) the research question, and (3) the presentation.

Construction of knowledge as mediated by students’ interests. Students’ interests shaped how knowledge was constructed – what Inquiry Question was selected, how sub-topics were divided between individuals or pairs, and what information stood out to students during their investigations. In describing how Group A selected Barbie, Sue said, “we just brainstormed all the topics we were interested in and voted” (I2.Sue. 42). Group C selected and divvyed up the sub-topics related to their initial research question as based upon Jane’s suggestion that they select the six organ systems that would be most interesting; each student then chose one system of their choice.

Further, interests appeared to influence what resources and literature were identified, favoured, and ultimately used to inform groups’ understandings. For example, B.S1 told his
group that he had been most interested in the nocebo rather than placebo effect – an interest that influenced him to identify and read articles about hormones, pain perception, and pain pathways. Based on this, the group incorporated these elements to include B.S1’s interests.

Knowledge construction both shapes and is shaped by a research question. While interests informed research question selection, the Inquiry Question itself both influenced the knowledge being constructed and was influenced by the discoveries made. Group C made decisions about what conjoined twin cases they would present given that their question was: how do two people live in one body? For example, they decided that twins who died as a result of their anatomical incompatibilities could not be the focus of their investigation. In another example, Heather (Group B) described how their group was finalizing their research question based on the research they had found: “what we find is what we taper our question towards almost” (I2.Heather, 68-69).

Construction of knowledge upon presentation. Finally, groups were focused on the end goal – the presentation – so that knowledge was constructed around the presentation itself. When groups were dividing their Inquiry Questions into sub-topics, they considered the presentation in guiding their decisions. As C.S1 said, “I think we could split the presentation, like what sections of the presentation are going to be” (FM3.C. 211-212).

Further, groups shaped their investigations based upon what they thought should and could be communicated in the 15-minute presentation timeframe. For example, B.S1 suggested to his group that they did not need to spend too much time elaborating on structures of the brain because they were “only presenting for 15 minutes” (UFM.B. 469). Finally, groups used the structure of their presentation to make decisions about how they would integrate their respective research areas together. For example, as Lyn, B.S2, and B.S3 conversed about treatment options for anorexia patients they drew upon each other’s research to decide that the presentation should highlight one or two main ways in which treatment options aim to promote weight gain.
Fostering interests. As highlighted above, interests were drawn upon to shape the Inquiry Question, to determine how sub-topics were divided, and to inform the identification of literature and resources. In exploring the impact of interests further, a common meaningful theme of “fostering interests” arose from the data to represent the ways in which students’ interests were fostered and encouraged throughout the project. In capturing this theme, three main sub-themes emerged: (1) a focus on interests were emphasized by facilitators, (2) group members encouraged and supported one another’s interests, and (3) groups aimed to convey their interests to others through the presentation.

Interests as emphasized by facilitators. Facilitators played a central role in emphasizing a focus on interests from the outset of the project. In the first facilitated meeting, FA encouraged Group A to use the Inquiry Project as an opportunity to explore what they were interested in. Similarly, in Group C’s first facilitated meeting, FC gave examples of how other Inquiry groups had chosen their Inquiry Question based on what they were most interested in. Further, in Group B’s second facilitated meeting, FB encouraged conversation by asking:

So have you guys thought of any research topics for [the Inquiry Project]? Like what are you guys interested in? [The Inquiry Project] is you guys choosing a topic that you guys are really interested in so why do you study anatomy in the first place? …. Like, what interests you about anatomy? (FM1.B. 456-459)

Encouraging and supporting one another’s interests. Group members regularly encouraged and supported one another to express and explore their interests. When students in Group B shared their ideas for the Inquiry Question with one another in their second facilitated meeting, they premised their ideas with comments such as “I found this and thought it was interesting” (FM2.B. 124) and “I was really interested in conjoined twins” (FM2.B. 185). Jane explained how Group C had “found this topic that we were interested in” (I2.Jane. 208-209) and how they continued to draw upon one another’s interests to make decisions on what topics would
be researched and what information would be presented. For example, when the group was selecting who would take responsibility for investigating which organ system, they encouraged one another to select the topic area each person identified as interesting to them.

**Conveying interests.** Toward the later stages of the project, groups were focused on conveying and fostering a sense of interest within their audience members (peers from the Anatomy Course) who would be in attendance at their presentation. For example, members of Group B discussed how they wanted to begin their presentation with “something that is interesting that like hooks [the audience]” (FM3.B. 271). Further, Group C had decided to incorporate video clips highlighting the way in which conjoined twins engaged in daily activities. The group agreed that the videos would help make connections between “the anatomy to actual problems and [life implications]” (FM4.C. 529-530) in a way that would be interesting to the audience.

**Working together.** All three groups used a combination of group, partner, and individual work to accomplish the various tasks required of the project. A theme of ‘working together’ arose in capturing the collaborative and distributed nature of this group work. Three main sub-themes emerged from this data: (1) moving back and forth between working together and working independently, (2) working together by talking, and (3) working together by coming together.

**Moving back and forth between working together and working independently.** Through observations and interviews, students both demonstrated and spoke about how they had worked closely with one another for certain aspects of the project, while other aspects were performed more independently of one another. Overall, the groups went back and forth between collaborative and independent work. Their efforts to select an Inquiry Question and develop a research plan were collaborative, while research activities such as identifying sources of information, reading articles, consolidating information, etc., were done more independently of one another. Groups’ efforts to consolidate their understandings in devising an outline for their
presentation were done collaboratively, while various chunks of the presentation were developed more independently. Finally, the groups collaborated to refine and rehearse their presentation in preparation for the presentation day.

Various examples highlight the collaborative-independent mix to the work. Sam described how Group B had “decided to split up the roles” and divide research subtopics between members “so we could go into more in-depth research into a certain area of it” (I3.Sam. 33.35). On Facebook, A.S3 (Group A) wrote, “When we meet up to discuss our research, we can decide then what we want to keep/ what's relevant for the flow [of the presentation]” (FBO.A.129-130).

FB, the facilitator for Group B, noted how:

after collecting information from the various resources, [Group B] came together and presented their information to each other and decided what was left to be done and what was redundant. Then, at the fourth facilitated meeting they were able to complete their research and they were also able to do some preliminary organization of the information to into the presentation (I.FB. 309-313).

**Working together by talking.** NVIVO word frequency analysis of the data related to “Working Together” revealed that the words talk, talking, talks, and talked were most commonly used in describing how students worked with one another. Students engaged with one another through conversation. Students talked in their face-to-face meetings but also talked online through Facebook and Google Docs pages. Online tools were regularly used to coordinate plans. For example, Jane (Group C) described how they had talked over Facebook to decide when to meet in person. However, online tools were also used to converse with one another about research activities. For example, Group B met for a synchronous online chat through Facebook.

Overall, talking mediated every aspect of the project – students talked in getting to know one another; they talked to coordinate meeting times and locations; they talked to brainstorm their Inquiry Questions, to devise their research plans, to share their understandings and knowledge, to
plan and edit the presentation. Simply put, working together would not have been possible without talking to one another.

**Working together by coming together.** Just as “talk” was a keyword arising from data related to “Working Together”, so too was the phrase “coming together”. Coming together had various meanings all referring to how people, knowledge, and information were integrated at various points through the project. People came together – meetings were arranged so that students could come together with their group mates and talk. For example, Lyn described how the Group A was “coming together after [conducting] our research” (I2.Lyn. 94-95).

Further, information and knowledge came together. Group B devised a plan to put together findings from a variety of peer-reviewed journal articles. Caleb suggested to his group that, “we could weave what we find together with our anatomical knowledge into something that could make sense” (FBO.C. 246). Information also had to be “put together” to develop the presentation. For example, A.S3 was going to “put together a Prezi presentation” (FM3.A, 138) by collecting different sections as developed by student pairs.

**Creative expression.** Just as groups fostered and encouraged each other’s interests, they were also focused on creativity as an important element of the project. Attention to creativity was stimulated by facilitators’ guidance. For example, in explaining the project to Group A, FA commented, “There’s a lot of room for imagination here” (FM1.A. 69). FB encouraged Group B to “keep an open mind, be open-minded and creative about this project.” (FM1.B. 489). In her final interview at the end of the project, Jane (Group C) commented that her group “was trying to be creative because they [FC and Prof] kept telling us to be creative” (I3.Jane. 46-47). In capturing the theme of creative expression, two sub-themes emerged from the data: (1) creative expression, storytelling and the presentation, and (2) creative expression to capture audience attention.
**Creative expression, storytelling and the presentation.** Creativity was most closely associated with the groups’ presentations. All three groups were creative with their presentations, expressing their creativity in different but related ways. Group A gave their presentation in the form of a skit where Barbie consulted with a team of physicians. Group B opened their presentation with a music video inspired by the television sitcom *The Big Bang Theory*. Throughout their presentation, Group B told a case study through a silent movie they had filmed. Finally, Group C incorporated a *Magic School Bus* theme into their presentation, performing a skit where *Magic School Bus* students reunited at university to tour and explore various cases of conjoined twins. In performing their skits and/or filming their videos, all three groups utilized a wide range of props such as clothing (lab coats and costumes), textbooks, construction paper, laboratory equipment, and food. Students also incorporated a range of multimedia into their presentations, using PowerPoint, Prezi, videos, music, and images to convey their ideas.

For Groups B and C, videos were an integral component to their presentation. Sam explained how the silent video case study was filmed by the group because of the way it helped them to creatively convey a story to the audience. The video, she said, “could kind of tie our entire presentation together in separate clips because you see a whole story unfold and kind of each her parts would be telling, like explaining further in depth of a part of the story” (I3.Sam. 307-309). Jane explained how Group C chose “to have the videos [of conjoined twins] playing silently for a little bit behind us [as we spoke], just because it was a little more interesting than the pictures” (I3.Jane. 232-233).

**Creative expression to capture audience attention.** Sam and Jane’s explanations for why video elements were used serve to highlight how considerations were given to capturing and holding the attention of audience members. Whether it was through video elements or a skit, all three groups were keen to incorporate creative elements into their presentation as a way to engage their audience. The incorporation of creative elements was seen as an alternative to dry, didactic
presentations. As Lyn (Group A) had explained, the group had incorporated fun and lighthearted elements into their presentation as an alternative to “slamming off information” (I3.Lyn. 488). Another example is found in the way that Group B had discussed how a good presentation ought to break up their explanations with various forms of media so that their presentation would be interactive instead of being “like a lecture” (FM3.B. 557).

A summary of common meaningful themes of group work between groups. Five themes were explored here in describing the commonalities between the three inquiry groups studied. These meaningful themes reflect the ways in which groups engaged in the project and worked together in completing it. All three groups took similar approaches in the way they constructed knowledge. As they researched, inferred, and learned, their interests mediated the process. They used their research question as a guide, and remained focused on the end goal of creating a presentation to share their knowledge with others. In exploring the role of interests further, it was found that interests were continually fostered and encouraged throughout the project. At the outset of the project, facilitators emphasized interests as a critical element of the project. As groups engaged in the project, they encouraged one another to use interests as a guide to inform decisions around responsibilities, research, the project focus, and presentation development.

All three groups worked well together as a cohesive team. In doing so, group members regularly went back and forth between collaborative and independent work to accomplish tasks. After working independently of one another, groups reoriented with one another by coming together, either in person or online, and conversing with one another. Finally, all three groups aimed to creatively express themselves through the Inquiry Project. The presentation was seen as an opportunity to be creative and captivate the audiences’ attention through storytelling, skits, and movies.
Common Meaningful Themes of Students’ Experiences

While the previous section of this chapter focused on meaningful themes arising out of the commonalities between groups and their collective approaches to completing the project, this section focuses on the commonalities found between individual students and their experiences of the Inquiry Project. Through interviews, observations, and artifacts all participating students – interview and non-interview participants alike – demonstrated shared sentiments and experiences in completing the Inquiry Project. These experiences could be organized into two major themes: (1) students experiences of the Inquiry Project as a unique learning opportunity, and (2) students experiences of learning as interconnected with the complex world around them. Each major theme could then be further characterized by sub-themes. Figure 8.2 outlines these themes and subthemes graphically and the remainder of this chapter delves in to each theme respectively.

Figure 8.2. Common meaningful themes of students’ experiences

**The inquiry project as unique.** The Inquiry Project was commonly described as something different – a learning experience unlike any other. For example, Jane said, “I like the project just because it’s different” (I2.Jane. 459). Heather explained, “I would say this is completely different from anything I have done in science courses” (I2.Heather. 545-546). In
explaining how the Inquiry Project was different, students contrasted their experiences in Inquiry to other learning experiences in their undergraduate studies. Instead of learning independently, students were working as a group. Instead of “just listening to a lecture or being assigned an assignment” (FI.FB. 226-227), students were “investigating their own topic of study” (FI.FB. 226). Instead of “cramming in tests and exams”, students were “learning at [their] own pace” (I2.Sam. 394). Instead of “being told what we are supposed to learn” and “having everything given to us”, students said they had the “opportunity to choose what we want to learn” (FM1.B. 122). In analyzing the various ways in which students contrasted their Inquiry experiences to other learning experiences, three sub-themes arose: (1) group work, (2) autonomy, and (3) memorization to application.

**Group work.** The group work nature of the project served as a key distinguishing feature for students. As previously highlighted in Chapter 4, FA (Group A) estimated that 90% of the students hadn’t done a group project in their undergraduate studies before the Inquiry Project (I.FA. 398). Students affirmed this estimate. For example, Sam said, “I don’t think we have really done any group work or group projects. Maybe like labs with a partner but nothing like this” (I2.Sam. 498) or as Heather said, “I’m looking forward to working as a group because I feel like I haven’t had the opportunity to work in a group since high school” (FM1.B. 81-82).

**Increased autonomy.** Students described an increased sense of control, freedom, and choice in learning. Various examples exist. Caleb described the project as “totally free” (I3.Caleb. 210). Heather commented how “it was nice to have the freedom to be able to decide where we wanted to take the project” (I2.Heather. 148-159). Jane described the project as “a little bit more self-directed than learning exactly what’s set in a curriculum” (I1.Jane. 267-268). Sue said of the project: “It’s very self-directed and it’s very free. You can explore on your own” (I2.Sue. 487-488).
Two elements, related to the theme of autonomy, help to explain how students came to feel this sense of freedom in learning. Those elements are: (1) the facilitator’s role, and (2) the way in which facilitators and students engaged in question posing.

**Facilitators Role.** Facilitators worked to encourage student-led discussion and decision-making, as demonstrated through the following quotes from interview students:

I feel as though [FA’s] kind of been more just in the background […] she’s been good, kind of like a guide I guess. [...] When we get into group discussions she doesn’t kind of interject, like she doesn’t go like I guess, add her opinions because really it’s supposed to be about ours (I2.Lyn. 290-291, 338-340).

[FB] is really open to letting us speak and do our own thing, give our ideas […] we’re probably also going to use him a as kind of mentor or advice kind of and bouncing ideas off of him to like kind of see if he has any advice for us and how we want to approach this” (I2.Sam. 193, 202-204).

[FC] is very diplomatic and like she won’t actually tell you straight up something’s bad, she will always help you […] like she will always try to like look at it from your perspective and see how you can actually fix it without telling you flat out like no (I2.Caleb. 409-410, 413-414).

Facilitators themselves reiterated how they had consciously worked to promote self-sufficiency and autonomy within their groups. For example, FB said, “I think this is really what [the Inquiry Project] should be about – students directing student learning. It’s not the facilitator always answering questions but the facilitator trying to guide the students where they can find the answer to their own questions” (I.FB. 102-105).

**Question Posing.** FB’s attention to question posing in the quote above draws attention to the second way in which autonomy was encouraged and fostered throughout the project, and that is through question-posing. Facilitators posed open-ended questions to their groups in stimulating
and encouraging student-led thought. At the outset of the project, facilitators asked open-ended questions to stimulate brainstorming, such as when FB asked, “So what are some of the ideas that you guys had since the last meeting about this project? What are you guys interested in?” (FM2.B. 65-66). Towards the end of the project, facilitators asked open-ended questions about presentation design. For example FC asked, “What sort of things do you think the audience will be appealed to in addition to the actual project topic itself? Like what sorts of things would you do to capture your audience’s attention?” (FM3.C. 705-707). These questions prompted student-led discussion and decision making throughout engagement in the project.

While facilitators maintained that they sought to answer questions with questions, their responses were observed to depend upon the nature of the question itself. If students posed a question related to structural or evaluative aspects of the project (i.e., when the personal goal reflections were due, what resources were available for the presentation, etc.) facilitators were more likely to respond with a straightforward response. However, if a student posed a question pertaining to creative aspects of the project (such as the nature of the Inquiry Question, where and how literature should be found and interpreted in answering the Inquiry Question, etc.) facilitators were more likely to respond with open-ended questions that stimulated student-led thought and problem solving. Students felt both supported and challenged by facilitators and the questions they posed. In general, this approach left students feeling supported in that they could ask questions and receive guidance on the project when necessary, but also challenged in that that facilitators were there to foster a sense of student ownership over the project.

While an increased sense of autonomy was, overall, a positive aspect of the project, there were circumstances in which students felt frustrated and even angry at the uncertain and ambiguous nature of the project. Students most commonly experienced feelings of uncertainty and frustration around two aspects of the project: (1) the Inquiry Question, and (2) the personal goals component. Jane exemplified feelings of uncertainty related to the Inquiry Question when
she said, “We were most confused about like what type of question we’re looking for, like how specific, how general should it be, how applicable it should be to what we’ve learned so far” (I2.Jane. 129). Caleb exemplified feelings of uncertainty related to the personal goals component when he wrote on the group’s Facebook page “With regards to the personal goals, how exactly are we supposed to present them to FC? The criteria given for these are ridiculously broad” (FBO.C. 118-119). Both of these examples serve to highlight the feelings of uncertainty regularly experienced.

Feelings of uncertainty tended to be temporal with students feeling most uncertain about the project around its outset – before it began through to the first or second facilitated meeting. Before the first facilitated meeting Sam (Group B) said she was “kind of unsure” because she “wasn’t sure what to expect from everyone” (I2.Sam. 100). However, after the second facilitated meeting she was “feeling a bit better” because “we kind of have an idea about what we’re doing and we are getting to know each other a lot better” (I2.Sam. 103-104). Overall, students tended to mitigate their feelings of confusion by consulting with one another and problem solving together. This aspect of experience is explored further in an upcoming section on the social relationships formed between students.

Memorization to application. Finishing up a consideration of the ways in which the Inquiry Project was described as unique, the sub-theme memorization to application is presented. This sub-theme refers to the way in which students felt they were applying knowledge rather than memorizing it.

There was an overall sense that memorization strategies predominated much of the students’ approaches in their first and second-year studies. As Lyn said, “To me, especially [in my program], it’s all just memorizing stuff – memorize, memorize, memorize” (I2.Lyn. 935-936). The Inquiry Project, however, did not depend on students’ ability to memorize the content taught
to them. Instead, they were applying anatomy “to something that [they] care about” (I2.Jane. 463) or putting their anatomy knowledge to use “in application to real life” (I2.Sue. 441).

While students spoke about the distinction between memorization and application, they also demonstrated it by putting their anatomy knowledge to use in new ways as they engaged in the project. An observation of Group C stands out as an illustrative example of this.

During their unfacilitated meeting time on March 25th, the group sat around a large conference table. Students were working in pairs to search for and identify literature on different types of conjoined twins. Jane and C.S3 were working together to investigate a case of conjoined twins who had been surgically separated. In discussing the separation, Jane and C.S3 began to wonder how the twin’s conjoinment and later surgery would have affected the twin’s upper limb anatomy and mobility. Jane suggested to C.S3 that the twins would have to learn how to engage in normal flexion, extension, abduction, and adduction at the shoulder joint. C.S3 then considered what muscles would be involved in those actions (content which he would have learned in his anatomy coursework), and how these muscles may have been altered in the twin’s case, before and after the surgery. In doing so, Jane and C.S3 were applying their understanding of the muscles and their anatomical actions to a novel problem. In her final interview, Jane reflected on this moment, saying:

There were times when we were trying to figure out the muscles and what muscles would have been cut or like reattached when they were separated. That was a time where I had to like look through my old notes, so it definitely did sort of bring back the content that we had learned and we understood what was going on in these different bodies, so I think it definitely did relate to the stuff that we had learned. (I3.Jane. 362-368)

This example highlights how the application of anatomy knowledge in new ways was a significant and meaningful experience to students as they engaged in a project that was unique from other experiences of post-secondary studies.
**Summary of inquiry project as unique.** Overall, the Inquiry Project was a learning experience unlike any other for students. The project was unique in three main ways: (1) students had the opportunity to work in groups, (2) they felt an increased sense of autonomy and control over their learning, and (3) they felt they were able to move beyond the memorization strategies that had predominated their studies, and work instead to apply their interests and understandings in new ways.

**Learning as interconnected with a complex world.** The second major theme to arise from analysis of individual student’s experiences related to learning as interconnected with a complex world. In this section, four sub-themes are explored for the way in which learning was interconnected with wider social aspects of students’ lives. Sub-themes include: (1) stress, (2) motivation (3) being social, and (4) relevancy and applicability, and are each discussed in turn.

**Stress.** As second year undergraduate students in a competitive sciences program, students regularly talked about feeling stressed. Stress arose as a common meaningful theme of students’ experiences as they spoke about the pressures felt by engaging in their studies. Overall, feelings of stress arose from a triad of demanding academic studies, high expectations, and a self-perceived lack of time management skills. This was poignantly illustrated by Heather when she commented that her stress was the result of a lack of effective time management coupled with very high expectations of herself.

Their academic program was so demanding that students talked of being “suffocated” (FB.C. 171) by their courses, “swamped with midterms” (I2.Sam. 346) and “engaging in crisis management” (FM4.C. 650-651) just to get through exam period. Within this demanding environment, students wanted to do well. They wanted to study effectively to see progressive improvements to their grades. However, time management was a necessary skill and many students felt they struggled with procrastination, distraction, and scheduling difficulties. For example, C.S2 said, “I always end up leaving things to the last minute and it gets super stressful”
The theme of stress was most closely associated with the personal goals component of the Inquiry Project. Eleven of the 18 student participants (61%) (A.S4, B.S1, B.S3, B.S4, C.S1, C.S2, C.S4, Heather, Sam, Jane, Caleb) either aimed their personal goal directly at reducing stress or set a personal goal that was informed by feelings of stress (i.e., aiming to better manage time). To achieve their goals, students tended to focus on implementing strategies for scheduling their time better and/or employing stress management techniques. By actively managing their stressors over the course of the project, each of the eleven students reported positive advances in reducing their stress.

In identifying their feelings of stress and actively managing them, students regularly made connections between stress and their wellbeing in other aspects of their life. Heather wrote that by reducing her stress levels she would “consequently be a happier, healthier individual” (PG1.Heather. 14). In her first reflection, B.S4 spoke of how procrastination and resulting stress had been negatively impacting her “physical and mental health” so much so that she was not enjoying her studies and was losing sleep. By her third and final reflection, B.S4 reported she was getting more sleep and managing her time better, two changes that “have helped me tremendously” (PG3.B.S4. 35). Despite these improvements, B.S4 recognized that “I am still quite stressed in spite of a more balanced work schedule. I think this is simply due to the sheer amount of work that comes from having five very demanding courses” (PG3.B.S4. 30).

**Motivation.** Overall, students were highly motivated to engage and learn in the Inquiry Project. In characterizing motivation, it was found that students became increasingly motivated as the project developed. As the topic of Inquiry was selected, students described feeling their motivation increase out of interest. As presented in Chapter 5 (Group B), Heather and Sam both felt increased motivation as their interests in the project grew. For example, Heather said “I am
more motivated because I am more interested in what we are doing because we have a topic picked that I am interested in” (I2.Heather. 447-448). Toward the later end of the project, motivation increased again with a desire to see the project completed and to share their ideas with others. For example, Jane (Group C) said “I definitely felt motivated to finish it and sort of present the work that we had done just because we were really excited about the topic” (I3.Jane. 417-418).

While the majority of students felt this way, Sue (Group A) and Caleb (Group C) did not. As presented in Chapter 4 (Group A), Sue did not find the Inquiry topic selected (Barbie and eating disorders) to be personally interesting. Instead, she was doing her work as she was supposed to do out of best interest of her group. This had negatively affected her motivation – at the beginning of the project she was excited but by the midway point she rated her motivation as “average” (I2.Sue. 403). Caleb had a similar experience in that his motivation waned as the project continued, not because he lacked interest in the topic but because his attention was elsewhere – “I was really motivated before the [midterm] exams but like, but now it’s sort of, it’s sort of tapered off” (I3.Caleb.808-809) as midterms, tutoring responsibilities, and other course work were dominating attention.

Various factors were motivating to students as they completed the project. As highlighted above, student’s interests in and excitement for the topic being explored as well the end goal of giving the presentation and seeing the project completed, were motivating. In addition to these factors, students were also motivated by the group work nature of the project. As Lyn highlighted, “I just kind of wanted to make my group members happy and not have them disappointed in me, and I didn’t want to be the weak link in the group, so they were definitely a big motivation” (I3.Lyn. 539-542).

When it came to motivation, factors such as feeling responsible to group members, being interested in the selected topic, working towards the presentation, and sharing their project with
others were more motivating to students than grades. Facilitators tended to overestimate the role grades played in motivating students through the project. Each facilitator was asked what he or she thought motivated their groups throughout the project. FA replied, “Probably the marks” (I.FA. 234) and FB said, “I think that what really motivated them [was] one thing – academics – because this is part of their evaluation and they strive to succeed” (I.FB. 257-258). FC was the only facilitator to say that her group was likely motivated by the Inquiry Question itself. Despite the facilitator’s replies, students rarely mentioned feeling motivated by grades when it came to the Inquiry Project. The project was seen as “easy marks” and a “grade booster”, for example, Caleb explained, the Inquiry Project “realistically did help all of us boost our grades” however he continued on to say, “aside from that it was an opportunity to work together” (I3.Caleb. 204-205). Overall, the findings from characterizing motivation demonstrate how students were motivated by a wide range of factors related to their personal interests, social relationships, and engagement in learning.

**Being social.** As described earlier in this chapter, a common meaningful theme found in characterizing group work was the collaborative nature of the Inquiry Project. Related to this, students’ individualized experiences were characterized by getting to know their group mates and developing a strong sense of social connection. Students did not limit their interactions with one another to the business of the project alone, rather they got to know one another personally, they shared in their struggles and successes as students, and they socialized with one another.

**Getting to Know One Another.** Due to the way in which groups were randomly organized, students found themselves paired up with other group members whom they had not previously spoken with or gotten to know otherwise. For example, as presented of Lyn’s (Group A) experiences in Chapter 4, the project had been a positive social experience for the way in which Lyn got to meet new people. In forming these relationships, students made friends with one
another. Sue, who had begun the project as a timid and shy student, felt she had made meaningful friendships with her group mates, friendships that would continue into the future.

**Sharing in Struggles as Students.** In getting to know one another, students shared with one another in their daily struggles as students. Returning to Lyn as an example, she spoke about what she had learned in getting to know her peers, “I was like ‘oh maybe it’s just me that finds Life Science so hard’ but talking to other people, I realized like they are even struggling just to get through too, so it’s not just me it’s all of us” (I3.Lyn. 577-580). In all three groups, students regularly talked with one another about the difficulties they were experiencing in everything from accessing wireless internet service on campus (FM2.A), to challenging mid-terms evaluations in other courses (FBO.C), to their busy study schedules (e.g. FB.A). Sharing in these struggles, students sympathized with one another and in doing so, felt a greater sense of camaraderie between themselves.

**Socializing.** Finally, while students got to know one another as students, they also got to know one another socially. They talked with one another about their extra-curricular engagements (such as participating in the university’s running club, or going to yoga classes). They talked about social events, such as popular club and bar nights. They took breaks from their work to visit coffee shops together. They planned social activities together, for example, Group A arranged to meet for dinner in celebration of project completion (I3.Lyn) and planned to get together for a board games night (FM1.A.).

Overall, the Inquiry Project came to mean more to students than simply engaging in the work. As Caleb (Group C) said, the project came to feel “more of a social activity more than an academic thing” (I3.Caleb. 347). Others emphasized how getting to know their peers had become the defining feature of the project. For example, when Lyn (Group A) was asked what the overall purpose of the project had been, she responded, “To me, it was honestly a great way to kind of talk to more people in the program than I normally wouldn’t have”. Further, when Sue (Group A)
was asked what as most meaningful to her about the project, she also spoke of the people she got to know and the friendships she formed.

**Applicability and relevancy.** A fourth sub-theme of learning experiences as connected to a complex world, was that of applicability and relevancy. Students felt they had developed skills through the project that would be applicable and useful into the future. Further, students described how their Inquiry topic allowed them to make connections between anatomy and the societal issues they identified as important. Finally, the Inquiry Project served as an opportunity for students to creatively express science through their own perspectives.

**Developing Skills Applicable to Future.** Students deemed the Inquiry Project had supported them in developing skills that would be applicable and useful in their future studies, careers, and/or life in general. In particular, students described developing skills in three major areas: (1) group work skills, (2) time management skills, and (3) research skills.

First, students felt that the group work skills they were developing through the Inquiry Project would be relevant to other courses and their future careers. As described of Caleb’s experiences in Chapter 6, Caleb felt he was learning new study habits in new ways. When asked what the purpose of the Inquiry Project had been, Caleb described how it had served as an opportunity to practice group work and develop skills. In her personal goal reflection, B.S4 reflected on how the Inquiry Project served as an opportunity to practice being a “productive member of a team” (PG1.B.S4. 38) thus gaining invaluable experience that would be applicable to other courses. Further, Lyn’s (Group A) focus on verbal communication and Sue’s (Group A) focus on developing confidence with interpersonal communication were described by the students as having potential positive influence on their future group work and interactions with others into the future.

Second, students developed time management skills that were going to be applicable to other courses and managing the demands of life in general. In Chapter 5 (Group B) it was
described how Sam felt she had learned a lot of skills not typically made explicit in university learning, particularly time management. After focusing on a personal goal of time management throughout the project, C.S4 wrote in her final reflection that “I feel like working towards this goal has both improved my time management and taught me some things about myself that will be useful in the future” (PG3.C.S4. 100-103), including applying her developed skills to her future university studies, her upcoming summer job, and her preparations for writing the MCAT in pursuing her career goal of medicine.

Finally, students described the development of research skills that would be highly applicable to their ongoing studies. Similar to the way in which Sam described the development of research skills as a defining characteristic of her experience (Chapter 3 – Group B), other students also emphasized the value of the research skills they had developed. For example, B.S1 exemplified this when he said to his group members, “I definitely think [the Inquiry Project] is an outlet sort of, to further studies, for doing some sort of Master’s program or something where you do have to do a research project and possibly present at a conference or at least a small presentation in front of a board so it’s definitely sort of getting you to research” (FM1.B. 129-132).

*Topic as connecting anatomy to society.* Through the Inquiry Project, students made connections between anatomy and society, relating their anatomy knowledge to the everyday world around them as it related to their topic. When interview participants talked about the Inquiry topic in interview, they often spoke about how the topic fit within a larger societal context. Lyn (Group A) associated the topic of Barbie and eating disorders to media and body image. Heather (Group B) expressed how “understanding the anatomy of [drug interactions and reactions]” was interesting to her in relation to “daily life” (I2.Heather. 521), such as having a better understanding of the way in which her prescriptions could be working on her body and being better able to interpret mentions of placebo drugs in the news. Jane (Group C) found the
Inquiry project interesting due to the way in which she became familiar with conjoined twins as people with daily struggles and successes. Caleb felt the conjoined twins they were investigating were inspirational role models who could teach society about bodily acceptance and capabilities.

Through observation, students were noted to regularly discuss the connections they saw between anatomy, their topic, and the wider world. Group A, for example, reached out to a local eating disorder clinic in completing their research. They regularly talked about healthy eating and the way in which negative body image is perpetuated through media. Group B engaged in various conversations regarding medical ethics, the physician-patient relationship, media, and the pharmaceutical industry. Group C regularly talked about the conjoined twins they were investigating wondering how they worked together to engage in daily activities such as walking, playing sports, driving, eating, etc. Overall, the inquiry topics explored allowed students in all three groups to make connections between anatomy and wider issues in society.

Expressing science. As found in the meaningful themes between groups, creativity was a common element of the Inquiry Project. By finding creative ways to explore and present their inquiry topics, students found they were expressing and sharing science in new ways. As Lyn discussed, Lyn felt she was learning how to express science in new ways.

There are two poignant examples of this in the ways Groups B and C developed and applied the theme used in their presentations. In working with the Big Bang Theory theme, Heather explained how Group B was “playing off science, making science fun and relatable, exciting” (I3.Heather. 167). Further, Group C applied a Magic School Bus theme to their presentation, transforming the childhood show into a university reunion that the students felt they could relate to. Regularly, students from Group C joked that the Magic School Bus clarified scientific engagement for the way it promoted discovery, getting messy, and making inferences according to research. Overall, by working with science creatively students were engaged in
science as a fun, exciting, and relatable endeavor. They did so by relating their work to the television shows and media that resonated with them most.

_A summary of learning as interconnected with a wider world._ Overall, the Inquiry Project served as an opportunity for students to connect their learning with the wider world of their social lives. The above sections presented considerations of stress, being social, motivation, and relevancy as experienced by students through their engagement in the project.

_A summary of common meaningful themes of students’ experiences._ Overall, students demonstrated shared sentiments and experiences in completing the Inquiry Project so that common meaningful themes emerged for characterizing their experiences. The Inquiry Project was unique for students from other learning experiences. They worked in groups, learned with an increased sense of autonomy, and applied their anatomy understandings in ways they had not previously experienced before.

Through the Inquiry Project, students’ experiences of learning were interconnected with the complex world around them. Their experiences were mediated by the stress they felt as undergraduate students. Students were motivated to work at the project by a wide range of factors related to their personal interests, social relationships, and engagement in learning. However, the project came to be about more than just engaging in the work, it came to be about meeting others, getting to know them as fellow students and friends. Finally, the project allowed students to relate anatomy and science in general to their lives (both current and future), society at large, and the media (i.e., television shows) that resonated with them.

**Chapter Summary**

In this chapter, I described the common meaningful themes shared between participants at the group and individual levels. In doing so, students’ experiences are explained and characterized. These results support the first research question posed of this research study asking how students’ experiences might be described and explained. In the next chapter, Chapter 9, I
focus on the second research question of this study, which explores students’ experiences of learning as potentially reflective of authentic learning.
Chapter 9

Reflections of Authentic Learning

A second research question asked: Is the essence of the learning experience reflective of authentic learning? And if so, how? This chapter explores these questions by considering the ways in which the common meaningful themes of student experiences (as discussed in Chapter 8) were analyzed in context of the theoretical framework of authentic learning (first detailed in Chapter 3). To do so, this chapter begins with a brief explanation of the thought process engaged in such an analysis. Later in the chapter, various aspects of findings arising from such an activity are discussed in depth.

Mapping Common Meaningful Themes to a Theoretical Framework

As explained in Chapter 8, common meaningful themes arose in describing and explaining students lived educational experiences of the Inquiry Project. Through this description, the essence of students’ experiences was characterized and the first question of this study was addressed. However, the culminating question of this work is whether such themes are reflective of authentic learning, and if so, how. To address this question, the common meaningful themes were mapped to the theoretical framework of authentic learning described in Chapter 3. The results of this mapping activity are organized in Appendix M.

First, each factor from the Theory of Authentic Learning was mapped against common meaningful themes of students’ experiences (middle column, Appendix M). For example, the factor of program was mapped onto the theme of approaches taken for inquiry because the curricular demands of the project established and informed the actions taken by groups. This mapping analysis indicated that the common meaningful themes of this study could be aligned with factors of Hill and Smith’s Theory of Authentic Learning. In fact, all twelve factors of Authentic Learning were represented within the common meaningful themes of students’ experiences. However, the question of how learning could be characterized as authentic remained
outstanding. Therefore, the mapping activity was further analyzed for reoccurring patterns. The following questions were asked: How frequently were the factors of Authentic Learning represented across the common meaningful themes of students’ experiences? What patterns could be found of the factors and qualities that were mapped? What was the nature and frequency of such patterns? What resulted from such an analysis was a visual representation of patterns found (Figure 9.1).

In Figure 9.1, each of the twelve factors from the Theory of Authentic Learning are represented by a rectangle. Factors are laid out such that they are, for the most part, positioned closest to other factors they connect to. Lines between the rectangles signify connections between factors. Two factors were considered connected when they were both found to relate to a single common meaningful theme. For example, program and situatedness are connected because they
were both mapped to the theme of approaches to inquiry, in addition to other themes. As can be observed in Figure 9.1 there were many connections between factors throughout the data, and there are two different types of connections between factors represented in Figure 9.1: (1) confirmatory (thick), and (2) novel (thin).

Confirmatory connections are those that mirror the same connections found between factors as described by Hill and Smith as part of the Theory of Authentic Learning (1998; 2003; 2005a; 2005b). There are many thick lines in Figure 9.2 indicating that all of the same connections between factors described as part of Hill and Smith’s Theory were confirmed within the analysis of students’ experiences. Novel connections (represented as thinner lines in Figure 9.2) are those connections that appear to be novel or unique to the context of students’ experiences in the Inquiry Project studied. In other words, they are novel or unique in comparison to the connections between factors as described by Hill and Smith (1998; 2003; 2005a; 2005b).

Considered together, confirmatory and novel connections serve to illustrate how students’ experiences of the Inquiry Project were authentic in nature but in ways that were unique to the context of engagement. Confirmatory connections indicate how aspects of student engagement and learning resembled the Theory of Authentic Learning, suggesting that students’ learning was indeed authentic. Yet novel connections distinguish students experiences’ and indicate a uniqueness contextualizing a novel interpretation of authentic engagement within the Inquiry Project itself. The remainder of this chapter is dedicated to discussing different aspects of confirmatory and novel connections to explore the nuances of authentic learning within the context of the Inquiry Project.

**Confirmatory Connections**

To reiterate, confirmatory connections were those that mirrored the same connections found between factors as described by Hill and Smith in visual representations of the Theory of Authentic Learning (1998, 2003, 2005a, 2005b). In their theory, Hill and Smith (2005a) described
twenty-six connections between factors. In this analysis of students’ experiences, the same twenty-six connections were found. These twenty-four connections represent the confirmatory connections of this study. Focusing on confirmatory connections led to two central observations regarding students’ authentic learning. First, connections were confirmed between the factors of situatedness, embodiment, mediation, and distribution in a way that closely resembled the Theory of Authentic Learning. Second, the connections found between identity and other factors closely resembled the central role of the factor. These two observations are each elaborated upon here.

**Connections between situatedness, embodiment, mediation, and distribution.** The first central observation to be explored is that of the connections between situatedness, embodiment, mediation, and distribution. These confirmatory connections emphasized, as Hill and Smith had found, that students were learning within a culturally relevant environment with and through engagement with others in a way that relied upon the use of physical, cultural, and linguistic tools as well as learning through the body’s own senses in a variety of ways. To expand upon this finding, each of these factors and the connections between them are considered in context of the Inquiry Project throughout this section.

**Distributed learning.** The learning that resulted from engagement in the Inquiry Project was not limited to each individual student but was collectively held between group members, in other words, it was distributed. Learners came to hold collective understandings built out of integrated understanding constructed from both individual contributions and collaborative synthesis of novel understandings. This engagement reflects Paavola and Hakkarainen’s (2005) description of Progressive Inquiry wherein “students collaboratively create the context, set up research questions, construct working theories, and critically evaluate the process” (p. 549) they’ve engaged in. The learning environment has “a multivoicedness, and associated ‘creative chaos’ rather than pre-structured and strictly controlled instructional processes” (p. 551). Groups integrated various individual interests, sharing a communal effort to create something new, and in
return, the “the social environment [fed] individual initiative and cognitive growth” (Paavola & Hakkarainen, 2005, p. 546). Consider the example of Group B where their inquiry into the placebo and nocebo effect was borne out of Heather’s personal interest, but was adapted over time to incorporate the curiosities of other group members (such as B.S1’s interests in pain pathways and Sam’s growing interest in ethical considerations).

**Mediation.** In Hill and Smith’s Theory of Authentic learning, distribution was associated with mediation - distributed understandings formed through the use of shared tools, language, and relationships. This association was found to be true of students’ Inquiry experiences. To engage in learning, particularly learning that was shared with others, learners made use of common tools – physical, electronic, cultural, and linguistic. In terms of physical tools, groups used paper, pens, laptops, and notebooks. They used electronic tools such as the Internet, Facebook groups, Google Documents, and software (i.e., PowerPoint and Prezi). These tools mediated learning in that they enabling students to document their thoughts and progress with ideas, but the tools also facilitated the distribution of learning. Tools allowed for a shared language to be developed and communicated. Tools also facilitated collaborative authorship. For example, using Facebook and Google Documents pages, group members shared ideas, thoughts, and resources as they worked remotely from one another.

In relation to mediation, Perkins (1993) spoke of the “residue left by thinking” (p. 90) – the cognitive and physical remnants of learning. When people collaboratively create, conceptual and material artifacts are produced (Paavola & Hakkarainen, 2005). The physical and electronic tools used by groups in the Inquiry Project not only mediated engagement in learning, they were used to produce artifacts of learning – notes, presentation slides, scripts, etc.

In addition to being mediated by physical and electronic tools, The Inquiry Project was heavily mediated by cultural norms and language. Students came together in their group with a common interest for developing group practices that would allow them to successfully complete
the project. While students were not assigned roles and responsibilities, groups were facilitated to make a peer evaluation rubric – an activity that established cultural norms of the group and encouraged members to explicate what practices and behaviours would be collectively upheld.

These elements of the Inquiry Project resemble a community of practice (Lave & Wenger, 1991) as described by Kimmerle, Moskaliuk, Oeberst, and Cress (2015). Such communities arise out of a common concern or a common interest to participate in shared practices. *I liked being able to all work together towards one common goal* (I3.Jane. 426-427). Through self-organization the community decides for itself the roles and positions of its members. The concept of a community of practice was first introduced in Chapter 3 in reference to the factor of situatedness, wherein learning can be situated in context of a community of practice. The findings discussed here demonstrate how learning was both situated and mediated around a community of practice where cultural norms arose of out a common goal for learning.

*Situatedness.* Paavola and Hakkarainen (2005) stated, “an approach that addresses processes of creating new knowledge and new artifacts collaboratively may simultaneously acknowledge situatedness of activity as well as the importance of mediating (conceptual and material) artifacts that are created in the process” (p. 553). This quote highlights the close association between distribution, situatedness, and mediation as found in the Theory of Authentic Learning. Learning was found to be authentic when it was situated within a culturally or professionally relevant context (situatedness), which invariably involved the use of specific tools unique to that context (mediation), and were used to connect, share, and engage knowledge with others (distribution), particularly professionals or members of the community in question.

Turning to the context of the Inquiry Project, elements of these factors and the connections between them were found. By engaging in a process of Inquiry, students were cognitive apprentices of an academic community of practice. The intended and enacted curriculum of the Inquiry Project was based upon Inquiry-Based Learning (IBL) reflecting
Aditomo et al.’s (2013) five key dimensions of IBL. It was an ongoing event over the course of a term, where the students were participants – co-inquirers – of a guided research-based activity. The learning goal of their engagement was to produce or author knowledge based upon a question or problem as posed by the students themselves (Levy, 2011, 2012). The project was a literature-based inquiry (Aditomo et al., 2013) where groups conducted a review of the scientific literature pertaining to the question posed. As co-inquirers engaged in question development, hypothesis generation, literature-based investigation, and authorship of knowledge, students were engaging much of the same cognitive processes that are engaged by academic researchers. *The Inquiry Project is probably a more accurate representation of what real research is* (I2.Jane.188-189).

Such cognitive tasks involved tools specific to the profession – journal articles, online library databases, and presentation software are three examples. Through engagement with these tools, students learned from experts in the field – for example, learning from the expert who authored the journal article. Further, two of the groups sought experts from the community. Group A contacted professionals at a local eating disorders clinic. Group B planned to interview a professor who specialized in placebo research. Overall, all of this goes to show how students were learning with one another in context of a professionally relevant academic community of practice as mediated by tools of the discipline.

*Embodiment.* Embodiment is the final factor of the quadruplet to be explored in this section. For the Theory of Authentic Learning, embodiment was characterized as learning with and through the body. In Hill and colleagues studies (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013), embodiment was found to be a part of situatedness, and a property of mediation. These connections reflect how learning, when situated within a relevant context, draws upon the sense-making ability of the body. Further, the connections reflect how the use of various tools within an authentic learning context invariably involve learning through the body and its sense-making abilities. An example of this from the Inquiry Project was the way in which students drew
upon their interests, feelings, and senses to make sense of their inquiries. Another example of this was the way in which students acted out their inquiries through presentation skits, music videos, and performance.

**Central role of identity.** The second central observation of confirmatory connections to be discussed is the central role of identity. This confirmatory finding emphasized how learning involved students’ identities. In other words, how the students’ sense of self both influenced learning and how learning came to be influential upon students’ sense of themselves.

The factor of identity was central to Hill and Smith’s Theory of Authentic Learning. Described as representing the “personal growth and the development of identity (who one is) and a sense of self” (Hill & Smith, 2005b, p. 27), the factor of identity not only represents one’s sense of self in learning, but the relationship between learning and a student’s lifeworld – the experienced world of meaning that the student relates to. As a central factor of Hill and Smith’s Theory of Authentic Learning, identity was associated with distribution, human relationships, teacher attributes, career planning, motivation, and multiple literacies. Further, embodiment was described as a part of identity. These connections served to signify the numerous ways in which a learner’s identity – their sense of self and lifeworld – affect and are affected by the way they relate to and work with others, how they engage their strengths or intelligences for learning, how they foresee and plan for their future, and how they are driven or moved to learn. In the present study, identity was also found to be just as central, with the same connections found between identity and the other factors listed above. The inter-related nature of these connections in context of the Inquiry Project is described in the next paragraphs.

Despite some initial hesitation regarding the group work nature of the project, students came to enjoy the collaborative, group-based nature of the Inquiry Project. Many of the students came to describe themselves as a productive member of the team. Thus, the relationships formed with one another (human relationships) and the distributed nature of their work (distribution)
influenced students’ sense of themselves as collaborators. The connection between identity and multiple literacies was characterized by the ways in which students described themselves as learners, understood their strengths and weaknesses as students, and came to see such notions being reflected in their engagement with the Inquiry Project. Take, for example, Lyn. Before the project began, Lyn described herself as an applied learner. Her sense of self was at odds with her regular learning experiences. "It’s just all memorization. I can’t just memorize." (I1.Lyn.124, 190) By engaging in the Inquiry Project, Lyn came to see her “applied learner self” reflected in the nature of the work, "I find things more interesting when you can apply real-world examples [...] so that’s why the inquiry project is good because it’s kind of putting a real-world spin on what we are actually learning in class" (Lyn.I2. 909-910, 914-916). This example serves to highlight the way students saw notions of themselves and their literacies as reflected in the curriculum.

The connection between identity and career planning is characterized by the way in which students’ identities are shaped by their goals for future study or career development. Students were enrolled in a competitive sciences program where current and future course work was demanding. There was a sense that peers were in competition with one another as the majority shared a desire to get into medical programs. "I mean, let’s face it like 75% of [us] want to be doctors" (FM2.B.494-495). Given these aspects of career planning, students’ identities were shaped by the characteristics and qualities they associated with such a path. I’m a perfectionist. I set very high expectations for myself (PG1.Heather.7). There was also evidence that students’ relationships with one another were influenced by such conditions. I always thought [my peers] were really studious (I3.Lyn.576). Thus, connections between identity, career planning, and human relationships were found. Finally, student’s sense of self was found connected to motivation, such that one’s identity – i.e., understanding oneself as a team player, as an applied
learner, or as a learner with particular career goals – served to motivate students in their engagement with the project.

**Novel Connections**

In addition to confirmed connections, novel connections between factors were found. To reiterate, novel connections are those connections that appear to be novel or unique to the context of students’ experiences in the Inquiry Project studied. Novel connections expanded upon the confirmatory connections, highlighting new insights into the situated nature of learning, the ways in which learning was mediated, the role of the program or curriculum, and the ways in which students supported one another as peers. These connections are explored within this section, and the factors of (1) program, (2) mediation, (3) situatedness, and (4) support network, and the connections associated with these factors are focused on as a way to organize the discussion of such novel connections.

**Program.** The factor of program represents those curricular elements that influence the learning environment and how learners experience the curriculum (Hill et al., 2013). As a factor, program was a relatively new addition to the Theory of Authentic Learning arising out of Hill and colleagues most recent work (Hill et al., 2013). Figure 9.2 highlights program and the connections found between it and other factors of authentic learning in the context of the Inquiry Project. Program was found to be connected to every other factor except for support network. In exploring program and its connections further this section first discusses the character of the Inquiry Project program.
Characterizing the inquiry program. In a previous section of this chapter, Aditomo et al.’s (2013) dimensions of IBL were used to describe the Inquiry Project as a guided, research-based activity where the learning goal of their engagement was to produce, or author, knowledge based upon a question or problem as posed by the students themselves (Levy, 2011, 2012). In addition to this description, three other defining aspects of the Inquiry Project curriculum were that, (1) students were organized into groups, (2) groups engaged in a process of inquiry for constructing knowledge, and (3) groups were guided through the process by facilitators.

Group Structure. A defining aspect of the Inquiry Project curriculum was that students were required to work in groups. Groups were randomly created on students’ behalf and students were regularly paired with classmates whom they did not previously know. This curricular design necessitated that the students share in the learning process with others. This finding is supported by research on inquiry curricula in post-secondary education. A group-based inquiry approach (as
opposed to independent study) tends to be favoured for inquiry approaches in large undergraduate classes, largely due to logistical reasons, but additionally because of the value recognized in prompting students to work with one another (Kraft, 1985; Oliver, 2007).

Process of Inquiry. A second defining feature of the Inquiry Project curriculum was the way in which groups worked through a process of Inquiry. Of the three models of IBL first explored in Chapter 3, Justice et al.’s (2007) model best captures the actions taken by the groups (Figure 9.3).

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Students began their inquiry learning by taking responsibility for learning. This was observed in each of the three research groups as they met with their facilitators for the first facilitated meeting to ask questions, clarify expectations, and develop a sense for how the group would be responsible for posing and investigating their own question. This caused the groups to engage a topic and develop basic knowledge. From this basic knowledge, a question was developed and the group determined what they needed to know by selecting their topics of investigation. By dividing the work up into pairs or individual chunks, the groups then identified resources and gathered data. Through avenues such as Google Docs, Facebook, and ongoing meetings, the group assessed, synthesized, and communicated findings to one another in working towards the final goal of communicating their understandings through the presentation.

Despite the suitability of Justice et al.’s (2001) model in describing the Inquiry process taken, the cyclical nature of the model does not fully capture the way in which groups went back and forth between determining what needs to be known, identifying, assessing, and synthesizing information in preparation for communicating their developed understandings. For example, after initial research had been conducted, all three groups devised a presentation outline by synthesizing the data they had collected and assessed. The groups then re-determined what they needed to know so they could identify further data and refine the ways in which they planned to communicate findings through the presentation. This process more closely resembles the criterion Construction of Knowledge from Newman et al.’s (2007) conceptual framework of authentic learning. Rather than reproducing knowledge in a linear fashion, novel understandings are constructed via organization, interpretation, evaluation, and synthesis of prior knowledge to solve new problems.

*Guided by facilitators.* A final defining feature of the Inquiry Project curriculum was the way in which groups were guided by student facilitators. Guided inquiry is distinguished from open inquiry based upon the level of involvement and guidance from a teacher or facilitator.
figure (Eick, Meadows, & Balcom, 2005). Guided inquiry is considered most appropriate for novice inquirers who require scaffolding and guidance through appropriate questioning and provision of support materials (Hmelo-Silver et al., 2007; McKenney, 2010). Facilitators played an important role in enacting the curriculum and so a factor of facilitator attributes was found to be closely associated with program. The factor of facilitator attributes is a derivative of Hill and Smith’s factor, teacher attributes, used to represent the inherent characteristic or quality belonging to a teacher, or in the case of the Inquiry Project, a facilitator. Facilitators were the face of the Inquiry Project curriculum. By the attributes they espoused, they promoted particular aspects of the curriculum. They emphasized student-led responsibility for learning, and encouraged students to engage in interest-based decision-making and exploration for inquiry.

**Novel connections with program.** Given the nature of the Inquiry curriculum, the factor of program was found connected to every other factor of the Theory of Authentic Learning, except for support network. The strongest connections were found between program and distribution, mediation, and multiple literacies. These connections relate to the ways in which the curriculum supported and encouraged students to work with and engage with one another. Program and distribution were connected as enactment of the group-based nature of the curriculum set an expectation for a distributed, collaborative approach. Groups were not told what to investigate, and instead, they came to draw upon one another’s interests and upon a wide range of resources, coming to shape their inquiries upon the multiple voices and creative energy arising from the collaborative approach.

Further connections were found between program and identity, embodiment, and situatedness. These connections relate to the ways in which learners came to see themselves within the project. The curriculum established students’ identities and literacies as a mediator of learning and engagement, and in doing so, learners embodied their interests as a way to frame their inquiries and investigations. Students were tasked with the curricular imperative of
investigating a question of interest to them, and so drew upon their sense-making ability to identify and focus on topics that interested them most. Interests then served as a mediator of learning – a part of the multivoicedness of group’s inquiries.

The factor of program was not found to connect to support network. While the group work nature of the Inquiry program formalized human relationships as part of the curriculum, support networks seemed to arise out of the more informal relationships established between peers such that the peers started to rely on one another for support.

**Mediation.** Mediation was first discussed above in connection with situatedness, distribution, and embodiment for the ways in which such associations resembled the findings of Hill and Smith’s work. Figure 9.4 highlights the connections found between mediation and other factors. In this section, new connections found between mediation and other factors are discussed that were found unique to students’ experiences of Inquiry.

![Highlighted connections of mediation](image)

*Figure 9.4. Highlighted connections of mediation*
Identity: embodied interests as a mediator. A major cultural and linguistic mediator of the Inquiry Project was the concept of interest. For the purposes of this discussion, interest is defined as the feeling or drive to learn more about something or someone; or a quality of excitement and curiosity holding one’s attention. Research on interest has demonstrated the strong influence it can have upon an individual’s cognitive and affective functioning. An interest can be both an individual predisposition and a psychological state of mind, overall characterized by focused attention, persistent effort, and increased cognitive functioning (Ainley, Hidi, & Berndorff, 2002). What someone is interested in – what stimuli, events, and/or objects that garner such a response – is understood to be very much a part of their identity and how they understand themselves. Ainley et al. (2002) found that interests mediate learning by triggering an affective response in students that results in heightened attention and persistence. In other words, a learner is excited by and driven to learn more about the topics, objects, or events that interest them.

For the Inquiry Project, learning was mediated by the various topics and ideas that grabbed the students’ attention. It was facilitators who first emphasized the importance of interests through the language used to describe the curricular intentions of the Inquiry Project. What interests you? (FM1.B.458) Interest quickly became the focus of attention. Students framed their own thinking around their personal interests (what interests me?) and emphasized the concept of interest as a guide for mediating discussion and decision-making amongst the group. Inquiry Questions were decided on as based upon what was most interesting, students volunteered to investigate particular sub-topics because they found it personally interesting, and groups’ presentations were edited and refined based on what would be interesting for others. In this way, students embodied the curricular imperative of interest. Facilitators did not need to continually encourage students to focus on interests, students did so themselves.
Online tools for collaborative work: mediation, distribution, and multiple literacies.

Connections between mediation, distribution, and multiple literacies are not new to a consideration of authentic learning. Hill and Smith (Hill & Smith, 1998, 2003, 2005a, 2005b) previously demonstrated connections between such factors – distribution and multiple literacies were found to be associated with one another; mediation was found to be a part of both distribution and multiple literacies. While the findings may resemble the Theory of Authentic Learning, a novel interpretation of the relationship between these factors is explored here – one that takes into consideration the way that online and social media tools related to considerations of students’ multiple literacies and the distribution of learning in context of the Inquiry Project.

When learning is distributed, tools mediate it. Throughout the Inquiry Project, all three groups relied heavily on online tools, specifically Facebook, Google Docs, YouTube, and search engines (Google, Google Scholar, and the institution’s own library database). Such tools are defined as social media, that is, information technologies that support interaction and collaboration among users in a way that allows for community building and knowledge exchange (Kimmerle et al., 2015). Tools such as Google Docs are described as a type of social media known as cloud computing application – a distributed computing paradigm that enables access to virtualized resources including shared development platforms or applications (Gonzoález-Martínez, Bote-Lorenzo, Gómez-Sánchez, & Cona-Parra, 2015).

In context of the Inquiry Project, there was no requirement for Inquiry groups to make use of social media tools. Groups elected to use the tools and selected which tools they would use for themselves. This finding is supported by research on post-secondary students’ use of social media for learning, which has found that students’ social media usage tends to arise from a “bottom-up, self organized process of active participation” (Kimmerle et al., 2015, p. 121). Students appear to select those social media tools that are regularly used in daily life, that commonplace, user-friendly, and freely available (Gonzoález-Martínez et al., 2015). Facebook,
Google Docs, YouTube, and the search engines used by Inquiry groups were a regular part of students’ lives before the Inquiry Project began. They selected such tools because it was a commonplace way to connect remotely, stay in communication, and organize the group’s work.

This reflects findings from previous research where social networking sites (such as Facebook) were found to be used for auxiliary purposes – organizing meetings, managing communications, sharing information about instructions or deadlines, and exchanging materials (Madge, Meek, Wellens, & Hooley, 2009; Greenhow & Robelia, 2009; Wodzicki, Schwämmlein, & Moskaliuk, 2012; Kimmerle et al., 2015). In other words, social media tools were found to mediate the ways students engage with one another allowing their work to be distributed with the support of these auxiliary activities.

During observation of Inquiry Project groups, it was clear that groups had selected such tools because of the high degree of comfort and familiarity they held of such tools. This aligns with findings that the generation born between 1980 and 1994 are digital natives characterized as possessing sophisticated knowledge of and skills with information technologies. Research of this generation has characterized digital natives as having particular learning preferences or styles that differ from earlier generations of students (Prensky, 2001a, 2001b; Tapscott, 1998, 1999). Research into such differences has posited digital literacy not as an integrated set of previously characterized literacies or skills, but as a learning style or intelligence unto itself (Aviram & Eshet-Alkalai, 2006). In fact, digital intelligence was suggested as a new addition to Gardner’s original Theory of Multiple Intelligences (Gardner, 1999).

Returning to a consideration of the Inquiry Project, it was observed, however, that students did not uniformly share a sense of digital literacy. Despite a collective agreement that tools such as Facebook and Google were commonplace and regularly used by all members of the Inquiry Groups, other tools were not as commonplace. Only some group members expressed a high degree of familiarity with tools such as Google Docs, particular features of Facebook
groups, and advanced aspects of literature search engines. Some students were identified as tech-savvy while others described themselves as not so technical. While the concept of digital intelligence has come to represent the unique literacies of today’s net generation, Margaryan, Littlejohn, and Vojt (2010) warn that educators should not assume that students “have the characteristics of epitomic global, connected, socially-networked technologically-fluent ‘digital natives’” (p. 439) because they may not. As Bennett, Maton, and Kervin, (2008) said, “The picture beginning to emerge from research on young people’s relationships with technology is much more complex than the digital native characterisation suggests. While technology is embedded in their lives, young people’s use and skills are not uniform” (p. 783).

**Situatedness.** Moving on now to a consideration of situatedness, novel connections between the factor and others are explored. Figure 9.5 highlights situatedness and the connections found between it and other factors. Hill and Smith had previously characterized situatedness to be connected to distribution, mediation, and embodiment. These relationships were discussed in the first part of this chapter. Situatedness was found to have three confirmatory connections and five novel connections. In this section, these novel connections are explored.
**Figure 9.5.** Highlighted connections for situatedness

**Situatedness and identity.** In focusing on their own interests for learning, students turned to events and topics as drawn from their lives beyond the classroom that held their attention or curiosity. The television shows students watched, the toys they had played with as children, the popular issues they had read about or heard about through the media, were each drawn upon in various ways across the Inquiry Project. Students came to orient in Inquiry Project in context of their lives beyond the classroom. This in turn had an impact upon their sense of self.

Consider Group C and their investigation of conjoined twins through a *Magic School Bus Theme*. The students first selected a *Magic School Bus* theme because it represented their childhood and how learning science, particularly anatomy, could be fun. However, the *Magic School Bus* theme also came to inform students’ understandings of inquiry and their engagement as inquirers. Caleb spoke of the *Magic School Bus* as representative of the exploratory and discovery based approach of their work. Similarly, Jane came to recognize that, as inquirers, this meant they must occasionally speculate and hypothesize in order to reach new understandings.
through research. This example illustrates how students’ identities were first drawn upon to shape the context for learning, and in turn, how the context further prompted development of students’ sense of self, particularly of themselves as learners.

A curriculum that allows students to bring elements of themselves into learning rather than enforcing experts’ notions of how learning should be conceptualized and practiced, is referred to by Cook-Sather (2002) as authorizing students’ perspectives. Authorship can be achieved through different pedagogies, such as constructivist or critical pedagogies.

Through a constructivist pedagogy, authorizing students’ perspectives occurs through “the continual and sympathetic observation of students’ interests” (Dewey, 1964, p. 436) and the development of pedagogical approaches that give students “the opportunity to explore ideas and to try to make more sense of them” (Duckworth, 1987, p. 65)” (p. 5). Authorizing of this nature was observed of the Inquiry Project, where students explored ideas relating to their ideas in an attempt to make more sense of them – for example, Lyn (Group A) explained how considerations of Barbie’s body had inspired questions regarding eating disorders and anatomical complications, an area that she had always been curious about and for which she now had more in-depth understanding of.

Comparatively, taking a critical pedagogy approach to authorizing student perspectives means empowering students to “critically appropriate knowledge existing outside of their immediate experience in order to broaden their understanding of themselves, the world, and the possibilities for transforming the taken-for-granted assumptions about the way we live” (McLaren, 1989, p. 186). For example, Sam expressed how her understandings of science had changed as a result of the Inquiry Project. For the first time in her studies, Sam was faced with questions that were unanswerable, no longer black and white, but rather up to interpretation. A change such as this signifies a transition in epistemological reflection (Baxter Magolda, 2001), where the student has changed from absolute knowing (where knowledge is understood to be
absolute, residing in an outside authority) to independent knowing (where knowledge is understood as less than absolute since individuals interpret and think for themselves). Hunter, Laursen, and Seymour (2007) closely associated this sort of epistemological development with identity development; a students’ way of knowing shifts from externally directed to more internally oriented. By validating students as knowers and situating learning in students’ experiences, meaning becomes self-authored and sense of identity has the potential to be effected.

**Situatedness and career planning.** Hill and Smith described career planning as the connection between learning and students’ goals for future study, careers, and/or work. In the section on identity, it was discussed how students career goals contributed to their sense of self and their relationships with others. While Hill and Smith had previously characterized connections between career planning, identity, and human relationships, they had not previously found a connection between situatedness and career planning, as was found here.

Such a connection suggests that learning during the Inquiry Project was situated in context of students’ goals for future study and work, and there were many ways in which this was found to be true. First, learning was situated in context of students’ interests, and such interests were often closely related to students’ career goals. For example, Lyn wanted to go into health care to help others. Hence, her interest for learning about eating disorders and treatment options was driven by a desire to understand, research, and eventually apply her learning to her career ambitions.

Second, many students related their personal goal development to future success in upcoming courses and future work. Some students chose to focus on an aspect of personal development that would relate to their career development. *Being able to communicate effectively will help me in my career* (PG3.C.S3.105-107). Others came to realize over time how valuable the personal goal component had been in context of their career development. Due to the way that the component required regular action, reflection, and metacognition of one’s goals for personal
development, students’ learning became contextualized in their action plans for enacting change and their reflections on the process. Students often came to realize that consciously working on a personal goal improved their ability to engage in their studies and in turn developed skills applicable to their future. As C.S2 wrote in her last reflection piece, “As long as I can keep improving on my time management skills I think that I will be able to successfully achieve what I want out of life by carrying these skills that I have acquired with me throughout the rest of my university career and throughout my life as well” (PG3.C.S2)

**Situatedness, multiple literacies, & human relationships.** In Chapter 6 (Group B), FB described how a focus on students’ interests required group members to accommodate for one another’s ideas and curiosities. Due to the group-based design of this project, students’ individual interests had to be negotiated with the interests of others. All three groups demonstrated an ability to democratically integrate various ideas together, developing an inquiry that was reflective of multiple interests. Hence, a connection between situatedness, multiple literacies, and human relationships was formed.

The focus on students’ interests appeared to elicit input and decision-making based upon individual strengths, weaknesses, and curiosities of the group members. As Oliver-Hoyo, Allen, and Anderson (2004) described of their group-based inquiry curriculum, “emphasizing collaborative work allowed students to capitalize on each student’s strengths” (p. 21). This collaboration required positive relationships between group members, and relationships between Inquiry group members were overwhelmingly positive. In her writing on undergraduate students’ experiences of group work, Burdett (2003) reviewed the literature on the challenges typically faced in a group work environment. Difficult group dynamics, assessment issues, and competition often present challenges that thwart effective working relationships. Inquiry Project students reported little to no experience with such issues throughout the project. Any potential assessment
and competition issues were negated by the grading structure that had self-, peer-, and facilitator-based assessment aspects built into the overall project grade.

**Situatedness, program, and motivation.** Earlier, it was discussed how the Inquiry Project curriculum created a situated context for learning both within an academic community of practice and within students own interests. In this section, the factor of motivation is explored in connection with program and situatedness to examine how and why the situated nature of the curriculum was so motivating for students in their learning.

In Chapter 3, literature was presented that explained how students are motivated when: (1) they feel competent, autonomous, and self-efficient in their learning, and (2) they feel a sense of relatedness or sense of belonging to the classroom (Deci & Ryan, 1985; Pintrich, 2003). Both of these elements were reflected through the common meaningful themes found of students’ Inquiry experiences. Students described feeling an increased sense of autonomy and freedom to explore topics that were of interest to them. A sense of relatedness developed out of focusing on their interests and using interests to guide the process of Inquiry. Finally, students demonstrated and expressed confidence with the knowledge they had developed. As an example, Sam talked in her final interview about how in preparation for the presentation she had practiced talking to herself ad lib about everything she had learned from the project. *I was talking to myself for hours* (I3.Sam.242-243). Her section of the 15-minute long presentation was 2 minutes. Her knowledge base far outweighed her presentation time that the presentation was kind of like automated (I3.Sam.237).

Presentation efficacy was characterized by Tucker and McCarthy (2001) as the belief in one’s capability to effectively communicate ideas through oral presentation. Finding that students regularly lacked the confidence to present, Tucker and McCarthy (2001) explored how students developed efficacy, particularly around oral presentation. Drawing upon the work of Wood and Bandura (1989), they described four ways in which self-efficacy is developed: (1) through
mastery experiences, where people become assured of their capabilities through repeated success, (2) through modeling, where observation and social comparison contribute to skill development, (3) through social persuasion, where realistic encouragement encourages effort and success, and finally, (4) through adjustments to psychological states, where positive affirmations, feelings of well-being, and reduced stress help build confidence. Overall, it seems that in context of the Inquiry Project, students felt a high degree of presentation efficacy attributed mainly to social persuasion and positive psychological states. The Inquiry presentation was one of the first encounters students had of oral presentations in their post-secondary studies, so presentation efficacy came more from the support students felt from their group mates (social persuasion) and the positive energy developed around the presentation (psychological state), than upon mastery or modeling.

Overall, this section has explored how the Inquiry curriculum (program) situated learning in context of students’ interests (situatedness), which in turn led to feelings of confidence leading up to groups’ presentations. The overall feelings of autonomy, relatedness, and competence gained through this work explain why students described a strong sense of motivation for learning.

**Support Network.** The final factor to be explored in this section is that of support network. Figure 9.6 highlights this factor and the connections found with others.
In this present study, support network was found connected to human relationships, identity, multiple literacies, and embodiment. These connections occurred in the context of two common themes of students’ experiences, specifically: being social and feelings of stress. Throughout the Inquiry Project, students got to know one another personally beyond their professional working relationships. They socialized with one another and shared in their struggles as students – particularly around the stressors they were feeling as students. Students were feeling a great deal of stress about their academic studies. As second year students, they held high expectations of themselves in an academically challenging and competitive program. Yet, in sharing their struggles with one another, students formed a sense of camaraderie – they may have all been struggling with the demands of their academic program, but at least they weren’t alone.

Interestingly, support network for Inquiry students was predominated by social support from peers, while support from others such as family members were rarely mentioned in context.
of students’ learning and experiences of Inquiry. This finding relates to research on undergraduate students and their social relationships, which has found friendships over family support to be central in students’ adjustment to university as they transition into campus lifestyle and away from their family unit (Swenson, Nordstrom, & Hiester, 2008; Friedlander, Reid, Shupak, & Cribbie, 2007; Fraley & Davis, 1997). Such research suggests that as students transition from high school to post-secondary studies they are transitioning from adolescence to adulthood. Throughout this transition, peer support becomes increasingly important for transition, adjustment, and academic success. While the research has focused primarily upon first-year undergraduate students, findings from this study suggest that second-year students are still engaging in a process of transition and adjustment, for which friendships continue to be the central form of support.

Friendships also appear to positively mediate undergraduate students’ emotional well-being. Michie, Glachan, and Bray (2001) found academic stress was reduced when students felt accepted rather than judged by their peers. Wright et al. (2013) found lower rates of depression in undergraduate students to be associated with higher support network satisfaction. Further, social support, especially from friends, is closely related to lower levels of academic burnout (Jacobs & Dodd, 2003). Such findings help to characterize the connections found between support network and identity as it related to academic self-concept and self-esteem.

Summary of novel connections. Novel connections expanded upon the confirmatory connections found of this study, highlighting that learning wasn’t just situated in a culturally relevant context, it was situated in context of students’ own identities, interests, and career plans. To achieve this as a group, students had to draw upon one another’s’ ideas and individual strengths. In doing so, they formed strong relationships that went beyond the ‘business’ of the project to form a support network between peers.
Chapter Summary

This chapter has focused on an analysis of the common meaningful themes of students’ experiences in context of the theoretical framework as informed by the Theory of Authentic Learning. Factors of Authentic Learning were mapped onto common meaningful themes and patterns within this mapping were analyzed to identify connections between factors. Through this analysis, all twelve factors of Authentic Learning were found reflected within students’ experiences. Further, many of the same connections between factors as described by Hill and Smith were also found. These connections were said to be confirmatory as they confirm the ways in which students’ experiences were authentic in nature. Other connections however were novel to this study and represent the unique ways in which students learning was authentic. This chapter has explored the nuances of these confirmatory and novel connections in explaining how students’ learning experiences of the Inquiry Project were authentic in nature.
Chapter 10

Authentic Inquiry Learning

The previous chapter focused upon reflections of Authentic Learning as based on analysis of common meaningful themes of students’ Inquiry Project experiences through the theoretical framework originally selected to frame this study. However, a goal during data analysis was to remain open to the possibility that other factors might emerge from the data. Whilst engaging in the process of analysis described in Chapter 9, I found myself consistently reflecting on the ways in which my observations seemed to be reflecting concepts I had noted through ongoing and regular reflection of the literature relating to authentic learning and inquiry learning. It appeared that there were shared qualities, identifiable within both the realms of both authentic learning and inquiry-based learning (IBL) literature, at play within the data; and while these qualities complimented the theoretical framework of the Theory of Authentic Learning (Hill & Smith, 1998; 2003; 2005a; 2005b; Hill et al., 2013) they also added to an understanding of students’ experiences of the Inquiry Project as authentic. This chapter focuses on those qualities that arose and how their presence informs the analysis of students’ experiences of inquiry as authentic.

A Process of Identifying Shared Qualities of Authentic and Inquiry Learning

The identification of shared qualities between authentic and inquiry learning came through ongoing reflection and consideration of the literature explored in Chapter 2. Over the course of this research study, I regularly reflected upon the literature – working to consolidate the ideas presented within the rich body of text related to both authentic and inquiry learning.
Figure 10.1 An initial attempt to integrate concepts of authentic and inquiry learning

The above figure (10.1) visually represents an initial attempt to integrate concepts from the separate bodies of literature (authentic and inquiry learning) into one explanatory model. The figure was created after I had completed a review of the literature but before collection and analysis of data, and therefore represents my initial inkling that there were shared aspects of authentic and inquiry-based learning. It was only with continued study, reflection, and analysis that my efforts at integrating concepts came to fruition. While engaged in data analysis as based
upon the theoretical framework (i.e. mapping common meaningful themes to factors of the Theory of Authentic Learning as described in Chapter 9), I created a third column in Appendix M where I recorded concepts as drawn from the wider base literature on authentic and inquiry learning that seemed to map onto each of the common meaningful themes. In doing so, five qualities arose: disciplined inquiry, instructor as facilitator, situated authentic context, construction of knowledge, and lived experiences for meaning making. The five qualities reflect an integration or marriage of authentic and inquiry learning together, such that qualities are neither solely authentic nor inquiry-based, but a hybrid of the two: Authentic Inquiry Learning.

**Authentic Inquiry Learning**

As defined above, Authentic Inquiry Learning is the characterization of inquiry learning as authentic in nature. There are five qualities of authentic inquiry learning, which are elaborated upon in the following section.

**Five Qualities of Authentic Inquiry Learning**

The five qualities of Authentic Inquiry Learning are both summarized in Table 10.1 and elaborated upon in the following sections.

<table>
<thead>
<tr>
<th>Disciplined Inquiry</th>
<th>Construction of Knowledge</th>
<th>Instructor as Facilitator</th>
<th>Situated Authentic Context</th>
<th>Lived Experiences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning activities are characterized as ill-defined and based upon complex problems and questions. Environments are to provide sustained and complex problems from which pertinent questions can be asked and explored.</td>
<td>The process engaged for constructing knowledge in reaching novel understandings through organization, interpretation, and synthesis of new information accomplished by collaborative and independent work.</td>
<td>Teachers serve as facilitators, coaches, or guides, who scaffold learning in such a way that allows students to navigate their learning as a student-centered activity.</td>
<td>Learning is situated in an authentic context resembling the disciplinary culture either in the sense that it provides cognitive apprenticeship or is peripherally legitimate to a real community of practice.</td>
<td>Students’ lives mediate the experience of making meaning for learning.</td>
</tr>
</tbody>
</table>
**Disciplined inquiry.** The quality of *Disciplined Inquiry* relates to the way in which Authentic Inquiry Learning environments frame learning upon questions and a process for inquiry. Both inquiry-based and authentic learning activities are characterized as ill-defined and based upon complex problems and questions. Environments are to provide sustained and complex problems (Herrington, 2006; Herrington & Herrington, 2005; Herrington & Oliver, 2000) from which pertinent questions can be asked and explored (Ai et al., 2008; Justice et al., 2001). Various models of a process for inquiry-based learning (i.e. Ai et al., 2008 and Justice et al., 2001) reflect what Newmann and Archbald (1992) referred to by Disciplined Inquiry where knowledge is integrated with in-depth understandings to go beyond reproduction of information to reach novel understandings. In the Inquiry Project, the quality of Disciplined Inquiry was most strongly reflected in the approaches groups took to engaging in the Inquiry Project, so as to construct knowledge through the integration of in-depth understandings to produce and apply novel understandings in autonomous and creative ways. The quality related most closely to the Authentic Learning factors of program, mediation, distribution, situatedness, and motivation.

**Construction of knowledge.** Similar to Disciplined Inquiry, a quality of *Construction of Knowledge* represents more of the process taken in reaching the novel understandings sought through disciplined inquiry. IBL and Authentic Learning draw on constructivist roots to characterize learning as a process of constructing knowledge. Learning is a cyclical practice where prior knowledge informs a process of asking questions, researching, evaluating, and synthesizing as an in-depth understanding of the problem at hand develops (Ai et al., 2008; Justice et al., 2001; Committee on the Development of an Addendum to the National Science Education Standards on Scientific Inquiry, Centre for Science, Mathematics, and Engineering Education, and National Research Council, 2000; Lee, 2013; Newmann et al., 2007). Models and frameworks of IBL (such as Ai et al., 2008; Justice et al., 2001), in conjunction with concepts of Authentic Learning such as Herrington and colleagues concept of “collaborative construction of
knowledge” and Newmann et al. (2007) concept of “construction of knowledge”, represent a cyclical process of knowledge construction wherein learners develop a question based upon prior knowledge, anticipate possible answers and determine relevant information, then identify, and assess that information in order to synthesize understandings together. The quality of Construction of Knowledge was most strongly reflected within the Inquiry Project through the ways in which students drew upon, organized, interpreted, and evaluated prior knowledge to reach new understandings. Questions, as informed by students’ interests and autonomous thinking, led to other questions in a cycle of inquiry that expanded understandings but also left students curious to explore those questions that continued to arise out of their inquiries. The quality was most strongly associated with Authentic Learning factors of program, situatedness, mediation, multiple literacies, human relationships, motivation, embodiment, identity, distribution and facilitator attributes.

**Instructor as Facilitator.** A quality of Instructor as Facilitator signifies the role of the instructor/teacher as a facilitator figure. In both IBL and Authentic learning environments, instructors taken on similar roles. They act as coaches, guides, or facilitators who scaffold learning in such a way that allows students to navigate their learning as a student-centered activity. Instructors facilitate the process of inquiry and moderate activities through timely feedback (Roy et al., 2003; Herrington & Herrington, 2005; Hill & Smith, 2005a, 2005b). In the Inquiry Project, the quality of Instructor as Facilitator arose in relation to the ways in which facilitators mediated group’s actions in progressively completing the project and through the ways in which facilitators promoted autonomous inquiry based upon students’ interests. Facilitators served two key roles in that they: in that they (1) initiated a focus on student-based interest, and (2) fostered student autonomy throughout the project through the questions they posed. The quality of instructor as facilitator was most closely associated with Authentic Learning factors of program and teacher/facilitator attributes.
**Situated Authentic Context.** A quality of *Situated Authentic Context* represents the way in which Authentic Inquiry Learning is framed in context of authentic practice. IBL and Authentic Learning both make the case for learning through some situated community of practice. By framing learning around the process and skills for scientific inquiry within a disciplinary context, IBL aims to achieve what the authentic learning literature calls for when it speaks of learning through situated contexts having real world meaning. IBL students are to engage in scientific inquiry as means of orienting themselves to the thinking and practice of a particular disciplinary culture where critical questioning and scientific reasoning are valued. In doing so, learning is situated in an authentic context resembling the disciplinary culture (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013; Herrington, 2006; Herrington & Herrington, 2005; Herrington & Oliver, 2000) either in the sense that it provides cognitive apprenticeship (Brown et al., 1989) or is peripherally legitimate to a real community of practice (Lave & Wenger, 1991).

In the Inquiry Project, the quality of Situated Authentic Context was most strongly reflected through the ways in which students engaged in a process and way of thinking that resembled elements of a community of practice in scientific inquiry. Learning was oriented within a disciplinary culture where critical questioning and scientific reasoning were valued. Students came to understand and express science and research much as the scientific community does – with applicability and purpose. They engaged and worked with one another as researchers often do – as collaborative partners who offer different areas of expertise. The quality was most closely associated with Authentic Learning factors of situatedness, embodiment, identity, and multiple literacies.

**Lived Experiences.** The quality of *Lived Experiences* represents the multitude of ways students see themselves and their world reflected in their learning. IBL and Authentic Learning argue that students’ lives mediate the experience of making meaning for learning. Of all the models and frameworks of IBL, Lee’s (2013) theoretical framework illustrates this point most
poignantly. Her framework depicts the learner as a person, “alert, attentive and curious” (p. 158) at the centre of her own experience. From this perspective, the learner integrates knowledge, methods, and values to form new meaning through inquiry. Authentic Learning on the other hand, strongly emphasizes the role of students’ lived experience for learning through the construct of the Lifeworld and its characteristics of temporality, spatiality, intersubjectivity, embodiment, and mood (Todres et al., 2007). Different academics use different terminology to represent the Lifeworld. Herrington and colleagues included the concept of reflection, citing individual and social metacognition as a factor of learning. Hill and Smith’s (2005a, 2005b) factor of program captures lifeworld elements of temporality and spatiality; the factors human relationships and support network relate to intersubjectivity; their factor of embodiment matches that of embodiment and mood. Despite different terminology, the overlap demonstrated here signifies how both IBL and authentic learning posit the learner as a whole person who operates out of their lifeworld or lived experience as a way of knowing and learning.

In the Inquiry Project, the quality of Lived Experiences was reflected in the ways students drew upon their interests, career goals, and emotions; making their inquiries relevant and applicable to their everyday lives. The quality was most closely associated with Authentic Learning factors of identity, embodiment, multiple literacies, support network, career planning and human relationships.

Orienting authentic inquiry learning with reflections of authentic learning. Through continued analysis of Appendix M, the factors and connections between factors as discussed in Chapter 9 were reanalyzed in context of the arising qualities of Authentic Inquiry Learning. This analysis showed that each of the five qualities were present in conjunction with nearly every factor and connection. For example, the connection between program and identity was associated with each of the qualities of Authentic Inquiry Learning at least once in Appendix M.
While the majority of factors and connections mapped onto each of the five qualities of Authentic Inquiry Learning in this way, there was one exception: the factor of support network was only mapped onto the quality of Lived Experiences.

**Exceptions with support network.** Support network and its connections were only mapped onto the authentic inquiry learning quality of Lived Experiences. Figure 10.2 depicts this finding visually.

These exceptions also resulted due to the way in which common meaningful themes, authentic learning factors, and qualities of authentic inquiry learning mapped together. Support network mapped onto two common meaningful themes: being social and stress. This mapping represented the way in which peer support was an important component of students’ learning when it came to being social and turning to peers when coping with academic stress. The authentic inquiry learning quality of lived experiences also mapped onto these two themes, due to the way in which learning was oriented in context of students’ emotions and social relationships with one another. It was in relation to these themes that the factor of support network, it’s connections with other factors, and the quality of lived experiences most closely aligned.
However, support network played less of a role in other aspects of students’ learning and was therefore not as pervasive through the qualities of authentic inquiry learning as many of the other factors.

Aside from the one exception noted above the qualities of Authentic Inquiry Learning wholly align with the theoretical framework of Authentic Learning (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013) as it was found to be reflective of students’ experiences of the Inquiry Project. This illustrates how the factors and connections found through the use of Authentic Learning as a theoretical framework, are, for the most part, representative of all five qualities of Authentic Inquiry Learning.

**Students’ experiences as authentic inquiry learners.** In Chapter 2, I explored three orientations to authenticity in learning: (1) learning as authentic to ordinary practices of culture, (2) learning as authentic to a community of practice, (3) and learning as authentic to students’ lived experience. What was unique of students’ Inquiry Project experiences was the way in which learning was authentic in all three of these ways; with emphasis placed upon students’ lived experiences as a source of authenticity. Students’ learning was situated in an academic culture of anatomical sciences; learning brought students, peers, teachers, and experts together as a community of collaborative learners; and, students were able to not only see themselves reflected in their learning, but they were challenged to draw upon unique ways of knowing and the uniqueness of their peers, to share in a process of meaning-making.

Authentic Inquiry Learning in anatomy education is therefore summarized as the construction of knowledge through a process of disciplined inquiry in a way that gets students engaged in authentic scientific inquiry that draws upon their identities as a way of making sense of and applying anatomical understandings.

The Inquiry Project program – the project’s curricular design and enactment – prompted the construction of knowledge through a process of disciplined inquiry in a way that not only got
students engaged in authentic scientific inquiry but in a way that drew upon their identities as a way of making sense of and applying anatomical understandings. Facilitators supported the enactment of this curriculum through promoting a process for inquiry and an emphasis upon interests and autonomy for learning.

As Inquiry groups engaged in the Inquiry Project curriculum, they formed a community of inquirers, sharing the work between themselves through the mediated use of tools and language representative of the academic culture of research and inquiry. Further, students’ lived experiences (their identity/lifeworld) were consistently drawn upon, not only through the incorporation of personal interests with the Inquiry Question itself, but through other components such as the personal goals. In this way, learning was situated in context of students’ interests, curiosities, likes, and dislikes in addition to being relevant to their goals for future study and/or work.

Overall, students’ experiences of the Inquiry Project were reflective of Authentic Inquiry Learning where authentic and inquiry learning came together and as a result, learning was accomplished through the construction of knowledge around a situated authentic context reflective of a community of inquirers as well of students’ interests. As a result, students came to apply anatomical understandings in context of their life around them. They made sense of anatomy in context of their interests, their career goals, and their relationships with one another as peers.
Chapter 11

Conclusions and Future Directions

This study sought to explore undergraduate students’ experiences of an Inquiry Project for learning anatomy. The project’s aims were twofold. First, to document, describe, and explain the essence of students’ experiences of engagement throughout the Inquiry Project, and second, to explore students’ experiences as potentially reflective of authentic learning. A hermeneutic qualitative case study approach allowed students’ experiences as lived to be captured through observation, interview, and artifact collection. Data analysis sought to describe students’ experiences and as a result, common meaningful themes of groups’ and students’ engagement were characterized. These results were then further analyzed through a theoretical framework of authentic learning, informed mainly by the Theory of Authentic Learning as described by Hill and colleagues (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013).

What was found was that students’ experiences were not only reflective of Authentic Learning – through the presence of confirmatory and novel connections between the twelve factors - but also reflective of shared qualities of Authentic and Inquiry learning integrated together. Students worked collaboratively to foster their inquiry-based learning as centred upon one another’s interests and curiosities, and in doing so, their learning came to both reflect and inform notions of authentic learning. The five qualities of Authentic Inquiry Learning that emerged from analysis of the data represent how students’ learning was neither solely authentic nor inquiry-based, but a hybrid of the two. Authentic Inquiry Learning in anatomy education is characterized as the construction of knowledge through a process of disciplined inquiry in a way that gets students engaged in authentic scientific inquiry that draws upon their identities as a way of making sense of and applying anatomical understandings.
Opportunities for Future Research

The qualities of Authentic Inquiry Learning as developed out of result of this work arose out of a case study of 18 undergraduate anatomy students and their facilitators. There is much opportunity for continued refinement and development of the concept of Authentic Inquiry Learning and its qualities with future continued research. Other contexts – other anatomy classrooms, other inquiry-based learning projects, etc. – would serve as valuable environments for continued study that would refine and expand understandings of Authentic Inquiry Learning.

In addition to expanded environments of study, expanded methodologies and methods for data collection would add value to a developing concept of Authentic Inquiry Learning. In this study, the qualitative methodology of a hermeneutic phenomenological design was necessary in order to obtain rich descriptions of students’ experiences and the resulting common meaningful themes. However, now that some initial qualities of Authentic Inquiry Learning have been identified other methodologies and methods would inform the concept further. Expanded research using qualitative, quantitative, or mixed methods approaches that could build and test a theory of Authentic Inquiry Learning would be most applicable.

Finally, a concept of Authentic Inquiry Learning arose out of the application of a theoretical framework informed by the Theory of Authentic Learning (Hill & Smith, 1998, 2003, 2005a, 2005b; Hill et al., 2013). What understandings might be developed of authentic learning if the same theoretical framework was applied in such a way to studies of problem-based learning environments? Online learning environments? Service-based learning environments? and so on. Further, what might such research tell us about the nature of learning itself? There is great opportunity for continued research in a variety of educational settings that would advance overall understandings of authentic learning and the student experience.
Contributions to Anatomy Education

At the very beginning of my first lecture in anatomy as a student, the professor stood at the front of the room and opened with a quote: “Structure without function is a corpse; function without structure is a ghost” (quote by Steven Wainright, as cited in Townsend, 2008). Anatomy education has been quite successful at treating the body as either the corpse or the ghost – with minute details of structure or function to be memorized and recalled at some later date for some later application. One question that has remained with me all these years, is – where is the living person in anatomy? The one who thinks, moves, and feels within the complex world in which it lives?

Authentic Inquiry Learning as an approach for learning has the opportunity to significantly change the way in which students engage with the discipline. Not only for the way in which it enlivens the human body in context of anatomical study, but for the way in which students are themselves the enlivened bodies of study; where anatomy is made sense of in context of one’s own muscles, bones, and organs as functioning not simply as muscles, bones, and organs but as complex structural systems functioning within a complex, messy world.

Contemporary scholars of anatomy education have worked to investigate and develop active, deep, and contextualized discovery of anatomical knowledge for the very reason that it deepens understandings and appreciations of the human body (Miller et al., 2002; Pandey & Zimitat, 2007; Smith & Mathias, 2007; Ward, 2011). However, this scholarship has been predominated by anecdotal evidence and a need for evidence-based research has been called for (Vorstenbosch et al., 2011). This study utilized a rigorous methodology for qualitative investigation and development of a framework of Authentic Inquiry Learning for achieving contextualized, student-focused approaches to inquiry and discovery in anatomy education.

Results from this study demonstrate how students can engage anatomical understandings to inquire and apply disciplinary considerations to their personal lives and the world around them.
Anatomy became contextualized in the creative interpretations of science as understood through personal interests, experiences, and life goals. Through their inquiries, students developed skills for scientific interpretation, information and digital literacies, teamwork, and creative lifelong development. The student learning experience was enhanced through the working relationships formed between peers and the learning that was shared and distributed amongst group members. Overall, an authentic inquiry approach to anatomical education meets the goals both of a discipline seeking to assert itself as a relatable and important area of study, but also of the post-secondary institution seeking to emphasize learning as an opportunity for skill development and active engagement.

In the end, structure without function is corpse; function without structure is a ghost, but only the living body – with its function and structure in context of the messy complex world around it - is alive. Authentic Inquiry Learning for anatomy education affords the opportunity to expand understandings of the human body as just that.

Figure 11.1 Andreas Vesalius, *De humani corporis fabrica* (1543)
References


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Tochon F. V. (2000). When authentic experiences are “enminded” to disciplinary genres: Crossing biographic and situated knowledge. *Learning and Instruction, 10*, 331-359. doi: 0959-4752/00/$


Vesalius, A. (1543). *De humani corpus fabrica libra septem.* Basileæ: ex offina I. Oporini


Appendix A – Student Package

Letter of Information for Students

STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY:
AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC EXPERIENCE

Dear Student,

This letter is to inform you of a study titled, Student Experiences in Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience. I, Lauren Anstey, am a doctoral student in the Faculty of Education at Queen’s University and am the researcher of this study under the direction of my supervisor, Dr. Ann Marie Hill of the Faculty of Education at Queen’s University.

This study aims to investigate students’ learning experiences of this anatomy course, and more specifically of the Inquiry Project. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

Not all those agreeing to participate in the study will be included in the study. All students voluntarily willing and interested in participating in the study will be subjected to selection criteria for determining inclusion in the study. Inclusion criteria will be based upon the organization of Inquiry groups. A staff member from the Department of Anatomy will be consulted in the process. Those students selected for inclusion in the study will be informed of their inclusion via email.

Student participants that have been selected for inclusion will participate in the study in four ways:

a) Participants will be observed during formal inquiry meetings, informal group work, and during the final inquiry group presentation. With permission, these sessions will be audio recorded.

b) Student’s final presentations will be video recorded.

c) Documents will be collected including curriculum documents (rubrics, outlines, etc.), copies of meeting minutes, copies of Facilitator notes, copies of submitted assignments as completed by student participants, and final presentation materials prepared by student participants. Documents may be collected from student participants and/or from their facilitators.

d) Interviews will be conducted with a subsection of student participants. A subsection of student participants will be invited to participate in a series of three interviews. These interviews will be conducted across the term: 1) before the Inquiry Project begins (late January to early February), 2) half way through the term (approximately late February to early March), and 3) upon completion of the Inquiry Project (early to mid April). Each interview will last approximately 60-90 minutes (overall time across the term: 3-4.5 hours) and will be conducted on campus. With permission, interview conversations will be audio recorded.

The time commitment expected for this study will depend on whether or not a participant has been invited to participate in the interview component or not. For those participants not involved
in the interview component, participation in the research study does not require any extra time or effort. For those participants involved in the interview component, a time commitment of approximately 3-4.5 hours will be required which will be spread across the term. Should a student be selected for interview, they will receive an email invitation. At that point, participants may decline participation in the interview component and opt for inclusion in observation, video recording, and document collection only.

The information collected from the above activities will include researcher field notes, video recordings, word-for-word transcriptions of audiotaped interviews, and documents as outlined above. All information will be stored on my password-protected laptop, encrypted external hard drive, and/or a locked cabinet (to which only my supervisor and myself have access).

Participation in any of the above activities is voluntary; the participant is free to withdraw from the study at any point. Participants are not obliged to answer any questions, provide any documentation, or continue with observation should they find such participation objectionable or uncomfortable. Participants may inform me, the researcher, of their wish to withdraw in person, by phone, or by email (contact information provided below). Withdrawing from the study will not effect the withdrawing participant’s standing in school and their standing in this anatomy course. Withdrawing participants can request removal of all or part of their data. There are no known risks to participating in this study. There is no remuneration for participating in this study.

Confidentiality will be provided to the extent possible. Each participant will be assigned a pseudonym (false name) in all field notes, transcripts, and documents collected in an effort to protect their identity. To protect participants’ identity further, all faces captured in video recordings will be blurred. There is no anonymity in this study.

Data collected will be analyzed and shared only after only after marks for the course have been submitted. Results of this study, including anonymized quotations, interpreted findings, frames and selected clips from video recordings may be included in the publication of this work in the form of a doctoral dissertation. Further dissemination of the work may include: written publications and reports; local, national, and international conference submissions; and formal presentations. Should the participant wish, the participant is entitled to a brief summary of the findings of this work.

Finally, in accordance with the Faculty of Education’s policy, data collected will be retained for a minimum of five years, after which point the data may be destroyed or retained indefinitely. Should the data be used for secondary analysis, it will contain no identifying information.

Agreement to participate in this study confirms understanding and acceptance of such provisions around confidentiality and anonymity.

Any questions about study participation may be directed to, Lauren Anstey, at lauren.anstey@queensu.ca or 613-533-6000, extension 77287; or the my supervisor, Dr. Ann Marie Hill at annmarie.hill@queensu.ca or 613-533-6000, extension 77432. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca

Lauren Anstey
PhD Candidate
Queen’s University
Student Consent Form

STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY:
AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC EXPERIENCE

Do you wish to participate in the study titled Student Experiences in Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience? Please check:

___ Yes (please complete the remaining form (2 sides) and the attached video consent form)

___ No (please do not complete the remaining forms)

1. I have read the Letter of Information and have had any questions answered to my satisfaction. I understand, should I be selected for inclusion in the study, I will receive a copy of the Letter of Information and a photocopy of my signed Consent Form at the first Facilitated Inquiry meeting.

2. I understand that the researcher will be applying the selection criteria to determine that all Inquiry group members have individually agreed to participate. I understand I will be contacted via email should I be selected for inclusion in the study.

3. I understand that the purpose of this study is to explore, document, and explain students’ experiences of learning anatomy through an inquiry approach. I understand that this means that I allow Lauren Anstey to a) observe me during formal Inquiry meetings, informal group work, and during my Inquiry final presentation, b) video record my group’s Inquiry final presentation, and c) collect documents related to the Inquiry Project. Further, I understand I may be invited to participate in a series of three interviews occurring across the Winter 2013 academic term. I understand that audio recording will be used during observations and interview sessions and that video recording will be used during observation of the final presentations.

4. I understand that the time commitment expected will depend on whether or not I am invited to participate in the interview component or not. If not selected for interview, then my time commitment would be minimal in addition to my regular Inquiry Project responsibilities. If selected for interview, then my time commitment would be approximately 3-4.5 hours of interview time, which will be spread across the term (3 interviews approximately 60-90 minutes in length).

5. I understand that my participation in this study is voluntary and I am free to withdraw at any time with no effect in my standing in school. Should I choose to withdraw, I may request removal of all or part of my data. I understand that every effort will be made to maintain the confidentiality of the data now and in the future.

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6. Anonymity and confidentiality will be sought, but cannot be guaranteed. Each participant will be assigned a pseudonym (false name) in all field notes, transcripts, and documents collected in an effort to protect their identity. To protect participants’ identity further, all faces captured in video recordings will be blurred.

7. I understand that, should I desire, I am entitled to a brief summary of the findings. (Note: If you wish to receive a copy, please provide a permanent email below).

8. I am aware that any questions about study participation may be directed to Lauren Anstey at lauren.anstey@queensu.ca or 613-533-6000, extension 77287; or her Supervisor, Dr. Ann Marie Hill at annmarie.hill@queensu.ca or 613-533-6000, extension 77432. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca

I have read the above statements (1-8) and freely consent to participate in this research.

Please sign this Consent Form and return to Lauren Anstey. Those students selected for inclusion in the study will receive a copy of the Letter of Information and a copy of their Signed Consent Form at the first facilitated Inquiry meeting.

Name (please print clearly): ______________________________________

Signature: ____________________________________________

Email: ___________________________ Phone Number: ______________________

Date: ____________________________

Should you wish to receive a brief summary of the findings, Please provide a permanent email: Email: ____________________________
Consent Form
For The Use Of Videotape Of The Final Inquiry Presentation

To facilitate observation of participants’ final presentations, video recording will be used. While these recordings will be used as raw data for analysis, frames or segments of video may be used in publication or academic presentation of the research. All faces captured on video will be blurred to protect identity. I understand that my name will not be associated with the work.

I agree to allow Lauren Anstey to videotape during my Final Inquiry Presentation:

_____ Yes  _____ No

If yes, Lauren Anstey may use this video recording in the following ways (Please initial):

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Name (Please Print Clearly): ________________________________

Signature: ________________________________

Date: ________________________________
Appendix B – Staff Confidentiality Form

Confidentiality Agreement for Staff of Department Biomedical and Molecular Sciences

STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY:
AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC EXPERIENCE

I, ________________________, agree to maintain full confidentiality of study participant details related to Lauren Anstey’s doctoral study titled Student Experiences in Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience.

I agree to hold in strictest confidence the identity of any individual that may be revealed during selection of study participants and the formation of Inquiry groups.

I am aware that I will be held accountable for any breach of this confidentiality agreement, and for any harm incurred by individuals if I disclose identifiable information contained in the audiotapes and/or files to which I will have access.

Staff Member’s name (please print): ___________________________________________________

Staff Member’s signature _____________________________________________________________

Date ______________________________________________________________________________
Appendix C – Inclusion and Exclusion Email Correspondence

Appendix [Inclusion Email]: Inclusion Email

Part A
Inclusion email sent to participants selected for inclusion in all components (interview, observation, video recording and document collection):

Dear [student’s name],

Thank you for agreeing to participate in the study titled Students’ Experiences of Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience. You have been selected for inclusion in the study. For your reference, I have attached a copy of the Letter of Information as well as a copy of the Consent Forms you completed.

You have been randomly selected to participate in the interview component of this project. Three interviews will be conducted across the term: 1) occurring in mid-January, 2) occurring late February to early March, 3) occurring early April. Each interview will last approximately 60-90 minutes and will be held in a private office [at a campus location]. As detailed in the Letter of Information, your participation in this project is voluntary and you may chose not to participate in this interview component.

Please respond to this email, specifying a time that works best for our first interview:

Next Week
Monday January 14th, any time of day
Tuesday January 15th, 4:30pm, 5:30pm, 6:30pm, 7:30pm
Wednesday January 16th, 9:30am, 10:30am, 11:30am, 5:30pm, 6:30pm, 7:30pm
Thursday January 17th, any time of day
Friday January 18th, 11:30pm, 12:30pm, 1:30pm, 2:30pm, 3:30pm, 4:30pm, 5:30pm

The Following Week
Monday January 21st, any time of day
Tuesday January 22nd, any time of day
Wednesday January 23rd, any time starting after 10:30am
Thursday January 24th, any time of day
Friday January 25th, any time of day

I will be attending your first facilitated meeting to begin my observations of the Inquiry Project. A facilitator will be in contact with you to arrange this meeting as [Prof] offers further details on the Inquiry Assignment.

Again, thank you very much!
Regards,
Lauren Anstey
**Part B**
Inclusion email sent to participants selected for inclusion in observation, video recording, document collection components only):

Dear [student’s name],

Thank you for agreeing to participate in the study titled Students’ Experiences of Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience. You have been selected for inclusion in the study (observation, video recording, and document collection components only). For your reference, I have attached a copy of the Letter of Information as well as a copy of the Consent Forms you completed.

I will be attending your first facilitated meeting to begin my observations of the Inquiry Project. A facilitator will be in contact with you to arrange this meeting as [Prof] offers further details on the Inquiry Assignment.

Again, thank you very much! If you have any questions, please do not hesitate to contact me.

Regards,
Lauren Anstey

**Part C**
Facilitator Exclusion Email, sent to facilitators not selected for inclusion in the study

Hi [Facilitator’s Name],

I appreciate you taking the time to read the Letter of Information. There are a limited number of Inquiry groups included in the project, which means only 3 facilitators were needed to meet the requirements of the study. Consenting facilitators were randomly assigned to the inquiry groups and I regret to inform you that you were not selected for participation in the research study.

Thanks for your support and all the best with this term,

Lauren Anstey
Appendix D – Facilitator Package

Letter of Information for Inquiry Facilitators

STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY:

AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC EXPERIENCE

Dear Inquiry Facilitator,

This letter is to inform you of a study titled, Student Experiences in Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience. I, Lauren Anstey, am a doctoral student in the Faculty of Education at Queen’s University and am the researcher of this study under the direction of my supervisor, Dr. Ann Marie Hill of the Faculty of Education at Queen’s University. This study aims to investigate students’ learning experiences of anatomy, and more specifically, when they take an Inquiry Project. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

Not all those agreeing to participate in the study will be included in the study. All facilitators voluntarily willing and interested in participating in the study will be subjected to selection criteria for determining inclusion in the study. Inclusion criteria will be based upon the organization of Inquiry groups. A staff member from the Department of Anatomy will be consulted in the process. Those facilitators selected for inclusion in the study will be informed of their inclusion via email.

Facilitator participants that have been selected for inclusion will participate in the study in four ways:

   e) Participants will be observed during formal Inquiry meetings and during the final Inquiry group presentation. Upon permission, these sessions will be audio recorded.

   f) Students’ final presentations will be video recorded.

   g) Documents will be collected including curriculum documents (rubrics, outlines, etc.), copies of meeting minutes, copies of Facilitator notes, copies of submitted assignments as completed by student participants, and final presentation materials prepared by student participants.

   h) One Interview will be conducted with facilitator participants at the end of the Inquiry Project. An interview will be arranged to discuss facilitator’s experience of guiding their Inquiry groups and Facilitator’s observations of student’s learning experiences. The interview will be conducted at the end of the Inquiry Project (approximately early to mid-April 2013). The interview will last 60-90 minutes and will be conducted on campus. Participants will be asked for permission to use of a digital audio recorder to record the interview conversation.

The overall time commitment for participating in this study is estimated to be 60-90 minutes in addition to the participant’s regular facilitator responsibilities.

The information collected from the above activities will include researcher field notes, video recordings, word-for-word transcriptions of audiotaped interviews, and documents as outlined above. All information will be stored on my password-protected laptop, encrypted external hard drive, and/or a locked cabinet (to which only my supervisor and myself have access).
Participation in any of the above activities is voluntary; the participant is free to withdraw from the study at any point. Participants are not obliged to answer any questions, provide any documentation, or continue with observation should they find such participation objectionable or uncomfortable. Participants may inform me, the researcher, of their wish in person, by phone, or by email (contact information provided below). Withdrawing from the study will not effect the withdrawing participant’s standing in school. Withdrawing participants can request removal of all or part of the information collected pertaining to them. There are no known risks to participating in this study. There is no remuneration for participating in this study.

Confidentiality will be provided to the extent possible. However, with only 3-7 facilitators being selected to participate in the study, there could be a risk of your identity being revealed. There is no anonymity in this study. Each participant will be assigned a pseudonym (false name) in all field notes, transcripts, and documents collected in an effort to protect their identity. To protect participants’ identity further, all faces captured in video recordings will be blurred.

Results of this study, including anonymized quotations, interpreted findings, frames and selected clips from video recordings may be included in the publication of this work in the form of a doctoral dissertation. Further dissemination of the work may include: written publications and reports; local, national, and international conference submissions; and formal presentations. Should the participant wish, the participant is entitled to a brief summary of the findings of this work.

Finally, in accordance with the Faculty of Education’s policy, data collected will be retained for a minimum of five years, after which point the data may be destroyed or retained indefinitely. Should the data be used for secondary analysis, it will contain no identifying information.

Agreement to participate in this study confirms understanding and acceptance of such provisions around confidentiality and anonymity.

Any questions about study participation may be directed to, Lauren Anstey, at lauren.anstey@queensu.ca or 613-533-6000, extension 77287; or the my supervisor, Dr. Ann Marie Hill at annmarie.hill@queensu.ca or 613-533-6000, extension 77432. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.G Reb@queensu.ca

Lauren Anstey
PhD Candidate
Queen’s University
Facilitator Consent Form

STUDENT EXPERIENCES IN UNDERGRADUATE ANATOMY: AN EXPLORATION OF INQUIRY LEARNING AS AN AUTHENTIC EXPERIENCE

Should you wish to participate in the study titled Student Experiences in Undergraduate Anatomy: An Exploration of Inquiry Learning as an Authentic Experience? Please read points 1-8 and complete the remaining form (2 sides) and the attached video consent form.

1. I have read the Letter of Information and have had any questions answered to my satisfaction. I have retained a copy of the Letter of Information and this Consent form for my records.

2. I understand that the researcher will be applying the selection criteria to determine that all Inquiry group members have individually agreed to participate. I understand I will be contacted via email should I be selected for inclusion in the study.

3. I understand that the purpose of this study is to explore, document, and explain the students’ experiences of learning anatomy through an inquiry approach. I understand that this means that I allow Lauren Anstey to a) observe me during formal Inquiry meetings and during students’ Inquiry final presentations, b) video record students’ Inquiry final presentations, and c) to collect documents related to the Inquiry Project. Further, I understand I will participate in a 60-90 minute interview at the end of the term (late March/Early April).

4. I understand the time commitment expected will be 60-90 minutes in addition to my regular Facilitator responsibilities.

5. I understand that my participation in this study is voluntary and I am free to withdraw at any time with no effect in my standing in school. Should I choose to withdraw, I may request removal of all or part of my data. I understand that every effort will be made to maintain the confidentiality of the data now and in the future.

6. I understand that confidentiality will be provided to the extent possible. There is no anonymity in this study. To protect my identity will be assigned a pseudonym (false name) in all field notes, transcripts, and documents collected. I understand all faces captured in video recordings will be blurred.

7. I understand that, should I desire, I am entitled to a brief summary of the findings. (Note: please provide your email or permanent mailing address below)

8. I am aware that any questions about study participation may be directed to Lauren Anstey at lauren.anstey@queensu.ca or 613-533-6000, extension 77287; or my Supervisor, Dr. Ann Marie Hill at annmarie.hill@queensu.ca or 613-533-6000, extension 77432. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca

[Please complete backside of page]
I have read the above statements (1-8) and freely consent to participate in this research.

Please sign one copy of this Consent Form and return to Lauren Anstey. Please retain the second copy for your records.

Name (please print clearly): ________________________________________

Signature: ____________________________________

Email: ___________________________ Phone Number: ______________________

Date: ______________________

Should you wish to receive a brief summary of the findings, Please provide a permanent email:

Email: ___________________________

Please note it is the participants’ responsibility to advise of any changes to permanent email address. Lauren Anstey can be contacted at lauren.anstey@queensu.ca
Consent Form

For The Use Of Videotape Of The Final Inquiry Presentation

To facilitate observation of participants’ final presentations, video recording will be used. While these recordings will be used as raw data for analysis, frames or segments of video may be used in publication or academic presentation of the research. All faces captured on video will be blurred to protect identity. I understand that my name will not be associated with the work.

I agree to allow Lauren Anstey to videotape during my Final Inquiry Presentation:

_____ Yes  _____ No

If yes, Lauren Anstey may use this video recording in the following ways (Please initial):

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</tr>
</tbody>
</table>

Name (Please Print Clearly): _____________________________________

Signature: _________________________________

Date: ________________________________
Appendix E – Observation Data Example

B.S1 sees this as an important area because it will be of interest to the audience because of their career goals: medicine. B.S1, “because that is what people are interested too, so if they are thinking in the future”

Sam looks at typed notes as she talks.

Sam, “I have like how in surveys they have found like doctors today are actually using the placebo effect like to a degree like the variable numbers of it are not that much but at least 15% of doctors, nurses and health care professionals have admitted to like, they have used the placebo effect at least once in their life” Sam explains that she has found various statistics on healthcare’s use of placebo. She says she found one article that predicts 17-85% of physicians have used placebo treatments because the survey’s come from everywhere. She explains the surveys are done anonymously because of the unclear ethical considerations surrounding the topic. She explains that the survey reported that placebos tend to be given to patients who are annoying or demanding where physicians “kind of just gave them the placebo. And it is generally used for stuff like pain, insomnia, or anxiety. One good thing that came from it though is that there are a lot of people who use placebos for patients who are at risk of substance abuse so like if they have like a history of getting addicted to drugs do you want to give them morphine or do you want to give them a placebo and see if it works first? Would that be safer for the patient, even if you are actually kind of lying to them? like would it benefit them? kind of thing. While impure kind of was more in primary health care settings like to do you doctor and a lot of the reason was because patients will do their own research like there is so much information on the web and they would be like ‘yea I heard so-and-so drug is really good for me and I am sure that it will work’ and who’s the doctor to say that ‘no its not going to work for you, I am not going to prescribe it to you’. When, but if they believe so much in this drug that perhaps maybe it would work. If its justified and kind of relevant, then the doctor may not know if it works or not but its worth a try, kind of thing”

*OC: I wonder what the impact of the pharmaceutical advertising industry on this.*

They talk and smile at one another.

B.S3, “one of the problems with the impure placebos like antibiotics for viral infections and stuff is that patients will go in and say ‘I want an antibiotic for this’. They are demanding it, but that is a problem too like especially with antibiotic resistance”
Sam, “I’ve been prescribed antibiotics for a viral infection. I am pretty sure I have. Because the common cold is a virus, right? Vitamin C works – don’t tell me otherwise. Vitamin C definitely stops me from not being sick.

Heather, “You know what would be a really interesting placebo, or exploring this, I don’t think. Because people take ColdFX before they get sick because they think like by taking ColdFX they are not going to get sick. I wonder if that has any clinical implications. This is like a huge thing for some reason like I heard about it in high school basically its these pills, I have no idea what’s even in them. I think they are natural whatever and basically the idea is you take one of these every day and by taking them you aren’t going to get sick. And people swear by them like ‘oh I’ve been taking ColdFX I am not going to get sick’ but I don’t know if that is placebo”

Sam, “My mom wears by that if you are getting sick you take some Vitamin C and you will get better, and I am like ok, but I am going to believe it and hope it works”

B.S4, “Yea that’s interesting I guess that’s like a lot of clinical things. How much have we allotted for that?”

B.S3 and Heather both look at their screen to see the estimated time
Appendix F – Student Interview #1 Schedule

Begin by asking if it is OK to turn on the tape recorder.

Today is ___________(date) at _________am/pm. This is Lauren Anstey with _____________.(interviewee).

Once again, I would like to thank you for participating in my study titled, *Students’ Experiences of Undergraduate Anatomy: Inquiry Learning as an Authentic Experience*. Just as a reminder, the purpose of this research is to explore, document, and explain educational experiences of students engaged in learning anatomy, particularly through an inquiry approach. The information collected in this audio taped interview with you will be transcribed, or written out word-for-word. Only my supervisor, Dr. Ann Marie Hill, and myself will have access to the information. [Prof] will eventually see the results of this study but only after the course has ended, all identifying information has been removed, and results have been summarized. For purposes of confidentiality, I will be replacing your with a pseudonym on all paper documents, which protect your identity. Do you wish to choose a pseudonym for yourself?

1.Q.1.1. Program and Year
What program and year of study are you in?

1.Q.1.2. Career Goals
What are your goals after completing this degree?

1.Q.1.3.1 Previous Courses
Can you describe some of the courses you have taken in your undergraduate studies so far?

1.Q.3.1 Previous Learning
How would you describe your learning in these courses?

1.Q.3.2. Self as Learner
How would you describe yourself as a learner? (How would you describe your attributes as a person and a learner?)

1.Q.3.3.1 Lived Experience - Past Learning
Try to remember one of the last times you learned something and tell me about that situation.

1.Q.3.3.2. Prominent Thoughts in Past Learning Experience
What thoughts stood out to you?

1.Q.1.4. Ideal Way to Learn
What would be the ideal way for you to learn?

1.Q.2.1. Expectations for Learning
What are your expectations or goals for learning in this anatomy course?

1.Q.2.2. Initial Understanding of Inquiry
How do you currently understand the upcoming inquiry component?
Appendix G – Student Interview #2 Schedule

2.Q.4.1.1. Inquiry Process
Can you describe your group’s progress so far on Inquiry Project?
Can you describe the thinking process that led you and your group to the topic and then the more specific question?
What is your Inquiry Question?
How has the group determined what they needed to know in order to move forward?
How have you worked to identify and gather data?

2.Q.4.1.2. Current Work
What are you currently working on or doing for Inquiry Project?

2.Q.4.1.3. Next Steps
What are your next steps? What does the group plan to do next?

2.Q.3.1. Lived Experience – First Facilitated Meeting
Let’s revisit that first facilitated meeting. What were you thinking and feeling as you began that meeting? How did you feel when the meeting was over?

2.Q.3.2. Lived Experience – Second Facilitated Meeting
Let’s revisit that second facilitated meeting. What were you thinking and feeling as you began that meeting? How did you feel when the meeting was over?

2.Q.2.2. Purpose of Inquiry Investigation
What does purpose your inquiry serve? In your opinion, what is the purpose of investigating this question?

2.Q.4.1.4. Role of Facilitator
What is the role of your facilitator? How have you been working with them?

2.Q.4.2.1. Facilitator Attributes
What attributes does your facilitator demonstrate?

2.Q.4.1.5. Role of Instructor
What is the role of [Prof] in Inquiry Project? How have you been working with them?

2.Q.4.2.2. Instructor Attributes
What attributes does your [Prof] demonstrate?

2.Q.4.1.6. Role of Group Members
What is the role of your other group members? How have you been working with them?

2.Q.4.2.4. Tools
What tools do you use?

2.Q.4.2.5. Sharing Information
How does your group share information?
2.Q.4.1.7. Information Literacy
When you are searching for resources, what are you searching for? What factors determine whether you will read and refer to the resource further?

2.Q.4.3.1. Inspiring/Informing Sources of Information
What sources of information have inspired or informed your topic so far?

2.Q.4.3.2. Talents and Skills
Has the Inquiry Project highlighted or brought out any talents or unique skills from you or your group mates?

2.Q.4.2.3. Motivation
How motivated are you currently feeling about this project? Has your motivation changed since the beginning of this project? If yes, how so?

2.Q.2.2. Expectations and Goals
What are your expectations or goals for learning in this anatomy course? Do you feel the Inquiry Project has a role to play in either supporting or hindering your achievement of this goal?

2.Q.2.3. Purpose of Learning Anatomy
In general, what is the purpose of learning anatomy? How does the Inquiry Project support that purpose?

2.Q.3.3. Lived Experience – Inquiry versus other education
How has your learning experience in Inquiry Project differed from other courses and projects in your degree?
Appendix H – Student Interview #3 Schedule

3.Q.4.1.1 Steps Toward Preparing for Presentation
Last time we talked, you were researching and just starting to think about the presentation. Can you describe the steps your group took as you transitioned from intensive research into preparing for the presentation?

3.Q.4.1.6 Group Work Toward Presentation
How did your group work together as you prepared for the presentation? How were responsibilities divided and how did the group determine who would do what?

3.Q.4.1.2 Determining Presentation Content
How did the group determine what content would be covered in the presentation and how it would be covered?
How did the group determine what research to include in the presentation?

3.Q.4.1.7 Unfacilitated Meeting times
How many times did your group meet outside of the facilitated meetings with your facilitator?

3.Q.4.1.8 Differences between facilitated and unfacilitated meetings
Were there differences between your facilitated and your unfacilitated meetings? If so what were they?

3.Q.4.1.4 Role of Facilitator
Overall, what was the role of your facilitator? Did the facilitator’s role change over time?

3.Q.4.1.5 Role of Course Director
Last time we talked a bit about [Profs] role in your Inquiry Project and you mentioned you he didn’t have a direct role to play – did that change at all toward the end of the project?

3.Q.3.1 Feelings before Presentation
Leading up to the presentation, how were you feeling about your Inquiry Project?

3.Q.3.2 Feelings during Presentation
During your presentation, do you remember thinking or feeling anything in particular? If so, what?

3.Q.3.3 Feelings After Presentation
What feelings or thoughts arose after the presentation was complete?

3.Q.4.2.4 Tools
What tools did you use for the presentation?

3.Q.4.2.2 Sharing Information
While you were researching and developing your ideas for the project, you shared quite a bit of information through Facebook and Google Docs. As you got closer to the presentation, did the group continue to communicate through these avenues? Did your practices for sharing information change at all?
3.Q.4.2.3 Facebook Likes
What prompted you to hit “like” in response to a group member’s post or comment on Facebook?

3.Q.4.3.1 Sources of Inspiration
What sources of information inspired or informed your topic?

3.Q.4.3.2 Talents and Unique Skills
Did the Inquiry Project highlight or bring out any talents or unique skills from you or your group mates?

3.Q.2.2 Meaningfulness
How meaningful was this project to you?

3.Q.2.1 Purpose of Inquiry
Overall, what would you say was the purpose of the Inquiry Project?

3.Q.4.2.1 Motivation
How motivated did you feel towards the end of the project?

3.Q.5.1 Criticism
What points of criticism do you have towards Inquiry Project?

3.Q.5.2 Inquiry Project as Part of ANAT 216
Should Inquiry Project be a part of ANAT 216? Please explain.

3.Q.5.3 Feelings of Pointlessness
Did anything about Inquiry Project seem pointless? If so, what and why?

3.Q.6 Final Questions
Do you have anything else you would like to add about your experiences in Inquiry Project?
Do you have any questions for me?
Appendix I – Facilitator Interview Schedule

Begin by asking if it is OK to turn on the tape recorder.

Today is ___________(date) at _________am/pm. This is Lauren Anstey with ____________ (interviewee).

Once again, I would like to thank you for participating in my study titled, *Students’ Experiences of Undergraduate Anatomy: Inquiry Learning as an Authentic Experience*. Just as a reminder, the purpose of this research is to explore, document, and explain educational experiences of students engaged in learning anatomy, particularly through an inquiry approach. The information collected in this audio taped interview with you will be transcribed, or written out word-for-word. Only my supervisor, Dr. Ann Marie Hill, and myself will have access to the information. Dr. MacKenzie will eventually see the results of this study but only after the course has ended, all identifying information has been removed, and results have been summarized.

4.Q.1.1 Program and Year
What program and year of study are you in?

4.Q.1.2 Past Experience
Have you been a facilitator for Inquiry Project before? If so, when?

4.Q.1.3 Motivation to Become a Facilitator
Why did you choose to become a facilitator for ANAT 216 the 2013 term?

4.Q.4.1.2 Role of Facilitator
What was your role as a facilitator? How did you work with your groups?

4.Q.4.1.3 Role of Professor
What role did [Prof] in Inquiry Project? How have you been working with them?

4.Q.3.1 Attributes as a Facilitator
How would you describe yourself as a facilitator? (How would you describe your attributes as a person and a learner?)

4.Q.4.1.1 Group Progress
Can you describe Group [A, B, C]’s progress throughout the Inquiry Project? What was your sense of the group at the beginning of the term? How did the group progress throughout the term? What was your sense of the group’s final presentation?

4.Q.3.3 Students’ Feelings throughout Project
How do you think students were feeling: At the beginning of the project? As the project progressed? During the presentation? At the end of the project?
4.Q.4.2.1 Students’ Motivations
What do you think motivated Group [A, B, C] throughout their project?

4.Q.4.2.2 Changes to Motivation
Do you think their motivation remained the same or changed across the semester?

4.Q.4.3.1 Sources of Inspiration
What sources of information inspired or informed Group [A, B, C]?

4.Q.4.2.3 Tools
What tools did Group [A, B, C] use throughout the project?

4.Q.4.2.4 Teamwork
How did the students appear to work with one another?
What was the nature of their teamwork?

4.Q.4.2.5 Communication
How did you communicate with Group [A, B, C]?

4.Q.3.3 Students’ Overall Experience
Overall, do you think the Inquiry Project was a positive or negative experience for students? Please explain.

4.Q.2.1 Facilitators Understanding of Purpose
In your opinion what is the purpose of learning anatomy through an inquiry approach?

4.Q.2.2 Facilitators Perspective of Students’ Understanding of Purpose
How well do you think the students understood the purpose of the Inquiry Project? Do you think they had a different understanding of the project’s purpose?

4.Q.4.2.4 Future Value
Do you believe the Inquiry Project will be of value to the students into the future? If so, how?

4.Q.5.1 Differences between Inquiry groups
How was Group [A, B, C] different from your other groups?
Motivation
Inquiry Question
Approach to inquiry
Teamwork or team dynamic
Conflict resolution

4.Q.5.2 Similarities between Inquiry Groups
How was Group [A, B, C] similar to your other groups?

4.Q.6.1 Recommendations for Improvement
What recommendations do you have for improving Inquiry Project for next year?

4.Q.6.2 Changes to Approach
Would you change anything about your own approach to facilitation?
4.Q.6.3 Recommendations to New Facilitators
What recommendations would you have to new facilitators just starting into their role?

4.Q.7 Additional Questions
Is there anything else would like to add about your experiences or your observations of your students in Group [A, B, C]?
Do you have any questions for me?
Appendix J – Lead Facilitator Interview Schedule

5.Q.1.1 Year of Study
What program and year of study are you in?

5.Q.1.2 Role of Lead Facilitator
Can you please describe your role as lead facilitator this term?

5.Q.1.3. Value of Lead Facilitator
What is the value of having a lead facilitator?

5.Q.4.1.2 Role of Facilitator
What was the role of the facilitator? How did the facilitators appear to work with the groups?

5.Q.4.1.3 Differences/Similarities in Facilitators
You had an opportunity to observe many of the facilitators – how did facilitators differ in their approach? How were they similar?

5.Q.2.1 Purpose of Learning Anatomy Through Inquiry
In your opinion what is the purpose of learning anatomy through an inquiry approach?

5.Q.2.2 Students’ Understanding of Purpose
How do you think the students understood the purpose of the project?

5.Q.3.4 Challenges for Facilitators
What, if anything, do you think facilitators struggled with?

5.Q.5.2 Changes to Lead Facilitator Role
Would you change anything about your own approach to your role as Lead Facilitator?
Appendix K – Approval from Queen’s University General Research Ethics Board

November 23, 2012

Mrs. Lauren Anstey, Ph.D. Candidate
Faculty of Education, Duncan McArthur Hall
Queen's University
511 Union Street
Kingston, ON  K7M 5R7

GREB Ref #: GEDUC-649-12; Romeo # 6007563
Title: "GEDUC-649-12 Student Experiences In Undergraduate Anatomy: An Exploration Of Inquiry Learning As An Authentic Experience"

Dear Mrs. Anstey:

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled "GEDUC-649-12 Student Experiences In Undergraduate Anatomy: An Exploration Of Inquiry Learning As An Authentic Experience" for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen's ethics policies. In accordance with the Tri-Council Guidelines (article D.1.6) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, of any adverse event(s) that occur during this one year period (access this form at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Adverse Event Report). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.

You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example you must report changes to the level of risk, applicant characteristics, and implementation of new procedures. To make an amendment, access the application at https://eservices.queensu.ca/romeo_researcher/ and click Events - GREB Amendment to Approved Study Form. These changes will automatically be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or irvinggg@queensu.ca for further review and clearance by the GREB or GREB Chair.

On behalf of the General Research Ethics Board, I wish you continued success in your research.

Yours sincerely,

Joan Stevenson, Ph.D.
Professor and Chair
General Research Ethics Board

cc: Dr. Ann Marie Hill, Faculty Supervisor
Dr. Don Klinger, Chair, Unit REB
Erin Wicklam, c/o Graduate Studies and Bureau of Research
## Appendix L – Mapping Participants Experiences to Common Meaningful Themes

### Chapter 4 – Students Learning Experiences before Inquiry

<table>
<thead>
<tr>
<th>Chapter Headings</th>
<th>Common Meaningful Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lyn.</td>
<td>Creative Expression</td>
</tr>
<tr>
<td></td>
<td>Inquiry as Unique</td>
</tr>
<tr>
<td></td>
<td>Memorization to Application</td>
</tr>
<tr>
<td></td>
<td>Motivation</td>
</tr>
<tr>
<td>Past academic studies as largely memorization.</td>
<td></td>
</tr>
<tr>
<td>Getting the gist of inquiry.</td>
<td></td>
</tr>
<tr>
<td>Sue.</td>
<td>Inquiry as Unique</td>
</tr>
<tr>
<td></td>
<td>Increased Autonomy</td>
</tr>
<tr>
<td></td>
<td>Motivation</td>
</tr>
<tr>
<td>‘I like to explore stuff on my own’.</td>
<td></td>
</tr>
<tr>
<td>A basic understanding of inquiry.</td>
<td></td>
</tr>
<tr>
<td>Heather.</td>
<td>Inquiry as Unique</td>
</tr>
<tr>
<td></td>
<td>Memorization to Application</td>
</tr>
<tr>
<td>Trained to write multiple-choice exams.</td>
<td></td>
</tr>
<tr>
<td>Expectations of anatomy and inquiry.</td>
<td></td>
</tr>
<tr>
<td>Sam.</td>
<td>Inquiry as Unique</td>
</tr>
<tr>
<td></td>
<td>Group Work, Memorization to Application,</td>
</tr>
<tr>
<td></td>
<td>Increased Autonomy</td>
</tr>
<tr>
<td>Learning strategies for demanding courses.</td>
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</tr>
<tr>
<td>The project as a scary mystery.</td>
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</tr>
<tr>
<td>Caleb.</td>
<td>Inquiry as Unique</td>
</tr>
<tr>
<td></td>
<td>Memorization to Application</td>
</tr>
<tr>
<td></td>
<td>Motivation</td>
</tr>
<tr>
<td>Adjusting approaches to learning.</td>
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<td>The Inquiry Project is mysterious.</td>
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<td>Jane.</td>
<td>Inquiry as Unique</td>
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<tr>
<td></td>
<td>Memorization to Application, Increased Autonomy</td>
</tr>
<tr>
<td>Learning to learn.</td>
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</tr>
<tr>
<td>Academic pursuits measured by interest.</td>
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<tr>
<td>I like all the buzzwords.</td>
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</tr>
<tr>
<td>Non-Interview Participants’ Experiences</td>
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</tr>
<tr>
<td>Past educational experiences: academic program, success, and stress.</td>
<td>Stress</td>
</tr>
<tr>
<td>Current understandings of inquiry: a unique opportunity for group work and research.</td>
<td>Inquiry as Unique – Group Work, Memorization to Application</td>
</tr>
<tr>
<td>Introductory Lecture</td>
<td>Construction of Knowledge as Mediated by Interests</td>
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<td></td>
<td>Fostering Interests</td>
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</table>
### Chapter 5 – Group A

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<tr>
<th>Chapter Headings</th>
<th>Common Meaningful Themes</th>
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<tbody>
<tr>
<td><strong>The Inquiry Process</strong></td>
<td>Construction of Knowledge</td>
</tr>
<tr>
<td></td>
<td>Fostering Interests</td>
</tr>
<tr>
<td></td>
<td>Working Together</td>
</tr>
<tr>
<td></td>
<td>Creative Expression</td>
</tr>
<tr>
<td></td>
<td>Being Social</td>
</tr>
<tr>
<td><strong>Experiences during the Inquiry Process</strong></td>
<td>Construction of Knowledge – as mediated by students’ interests</td>
</tr>
<tr>
<td>Lyn’s Experiences.</td>
<td>Working Together</td>
</tr>
<tr>
<td>Enthusiastic and motivated about a topic of interest.</td>
<td>Motivation</td>
</tr>
<tr>
<td>Making progress on the project through independent and collaborative work.</td>
<td>Applicability and Relevancy</td>
</tr>
<tr>
<td>Outstanding curiosity and further exploration.</td>
<td></td>
</tr>
<tr>
<td>Sue’s Experiences.</td>
<td>Inquiry as Unique – Increased Autonomy</td>
</tr>
<tr>
<td>Doing what is supposed to be done for the group.</td>
<td>Motivation</td>
</tr>
<tr>
<td>More freedom in learning.</td>
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</tr>
<tr>
<td>Peer Evaluation Component</td>
<td>Working Together</td>
</tr>
<tr>
<td>Personal Goals Component</td>
<td>Stress</td>
</tr>
<tr>
<td></td>
<td>Applicability and Relevancy</td>
</tr>
<tr>
<td>Lyn’s Personal Goal</td>
<td>Applicability and Relevancy</td>
</tr>
<tr>
<td>Sue’s Personal Goal</td>
<td>Applicability and Relevancy</td>
</tr>
<tr>
<td>Overall Experiences and Reflections after Inquiry</td>
<td>Creation Experience</td>
</tr>
<tr>
<td>Lyn’s Experience</td>
<td>Inquiry as Unique – Memorization to Application</td>
</tr>
<tr>
<td>Exploring and sharing interests through applying anatomy.</td>
<td>Applicability and Relevancy</td>
</tr>
<tr>
<td>Inquiry as a positive social experience.</td>
<td>Being Social</td>
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### Chapter 6 – Group B

<table>
<thead>
<tr>
<th>Chapter Headings</th>
<th>Common Meaningful Themes</th>
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| The Inquiry Process | Construction of Knowledge  
                           Fostering Interests  
                           Working Together  
                           Creative Expression  
                           Being Social |
| Experiences during the Inquiry Process | Construction of Knowledge – as mediated by students’ interests  
                           Fostering Interests  
                           Working Together  
                           Inquiry as Unique – Memorization to Application  
                           Applicability and Relevancy |
| Heather’s Experiences.  
  *Interest, relevancy, and motivation.*  
  *Group work and collaborative roles.* | Construction of Knowledge – as mediated by students’ interests  
                           Fostering Interests  
                           Working Together  
                           Inquiry as Unique – Memorization to Application  
                           Applicability and Relevancy |
| Sam’s Experiences.  
  *Increased motivation with interest and autonomy.*  
  *Taking a collaborative attitude.* | Construction of Knowledge – as mediated by students’ interests  
                           Fostering Interests  
                           Working Together  
                           Inquiry as Unique – Memorization to Application  
                           Applicability and Relevancy |
| Peer Evaluation Component | Working Together |
| Personal Goals Component | Stress  
                           Applicability and Relevancy |
| Heather’s Personal Goal | Stress  
                           Applicability and Relevancy |
| Sam’s Personal Goal | Stress  
                           Applicability and Relevancy |
### Overall Experiences and Reflections after Inquiry

<table>
<thead>
<tr>
<th>Heather’s Experiences</th>
<th>Sam’s Experiences</th>
<th>FB Experiences</th>
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<tbody>
<tr>
<td><strong>Time management.</strong></td>
<td><strong>Development of research skills.</strong></td>
<td><strong>Drawing on past positive experiences as a student.</strong></td>
</tr>
<tr>
<td><strong>Inquiry as a fun and enjoyable chance to be creative.</strong></td>
<td><em>‘It brought me into a whole world of ethics’.</em></td>
<td><strong>Sensing students’ initial unease and growing sense of comfort.</strong></td>
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<tr>
<td><strong>Unclear expectations.</strong></td>
<td><strong>The project wasn’t worth enough.</strong></td>
<td><strong>Observing the group sorting out ideas based on interests.</strong></td>
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<td><strong>Noting students’ increased knowledge and skills.</strong></td>
</tr>
<tr>
<td>Creative Expression</td>
<td>Inquiry as Unique - Memorization to Application Motivation</td>
<td>Construction of Knowledge – as mediated by students’ interests Fostering Interests</td>
</tr>
<tr>
<td>Inquiry as Unique - Memorization to Application, Increased Autonomy</td>
<td>Application and Relevancy</td>
<td>Inquiry as Unique - Memorization to Application, Increased Autonomy</td>
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### Chapter 7 - Group C

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<tbody>
<tr>
<td><strong>The Inquiry Process</strong></td>
<td>Construction of Knowledge Fostering Interests Working Together Creative Expression Being Social</td>
</tr>
<tr>
<td><strong>Learning Experiences during Inquiry Process</strong></td>
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<tr>
<td><strong>Caleb’s Experiences.</strong></td>
<td>Working Together Inquiry as Unique – Group Work, Memorization to Application Motivation Application and Relevancy</td>
</tr>
<tr>
<td><em>Quiet participation in collaborative and distributed work.</em></td>
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<tr>
<td><em>Revisiting anatomy material and deepened learning.</em></td>
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<tr>
<td><strong>Jane’s Experiences.</strong></td>
<td>Fostering Interests Inquiry as Unique – Memorization to Application, Increased Autonomy Motivation</td>
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<tr>
<td><em>Growing motivation and interest.</em></td>
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<td><em>‘It’s ok to speculate’.</em></td>
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<tr>
<td><strong>Peer Evaluation Component</strong></td>
<td>Working Together</td>
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<tr>
<td>Personal Goals Component</td>
<td>Stress Applicability and Relevancy</td>
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<tr>
<td>Caleb’s Personal Goal</td>
<td>Applicability and Relevancy Motivation</td>
</tr>
<tr>
<td>Jane’s Personal Goal</td>
<td>Stress Applicability and Relevancy</td>
</tr>
<tr>
<td>Overall Experiences and Reflections after Inquiry</td>
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<tr>
<td>Caleb’s Experience</td>
<td>Working Together Applicability and Relevancy Being Social</td>
</tr>
<tr>
<td></td>
<td>Inquiry as a positive experience of working with others.</td>
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<td></td>
<td>Frustration at the personal goals component and facilitator.</td>
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<tr>
<td>Jane’s Experience</td>
<td>Fostering Interests</td>
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<td></td>
<td>Inquiry as Unique – Group Work, Memorization to Application,</td>
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<td></td>
<td>Increased Autonomy</td>
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<td></td>
<td>Feeling part of a collective.</td>
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<td>Inquiry as different from the norm.</td>
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<td>Frustration at the personal goals component and facilitator.</td>
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<td>FC’s Experience</td>
<td>Working Together</td>
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<td>Inquiry as Unique – Increased Autonomy Motivation</td>
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<td></td>
<td>Not wanting to Interfere.</td>
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<td></td>
<td>Reflecting on facilitation approach.</td>
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<td></td>
<td>Observations of group dynamics.</td>
</tr>
</tbody>
</table>
Appendix M - Mapping Common Meaningful Themes to Authentic Learning

<table>
<thead>
<tr>
<th>Common Meaningful Themes</th>
<th>Factors from a Theory of Authentic Learning</th>
<th>Qualities of Authentic Inquiry Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Common Approaches Taken to the Inquiry Project by the Groups</td>
<td><strong>Program</strong> – approaches taken are reflective of the curricular demands of an inquiry-based approach</td>
<td>Construction of Knowledge – students organized, interpreted, and evaluated their prior knowledge to solve new problems</td>
</tr>
<tr>
<td>Getting Started</td>
<td><strong>Teacher (Facilitator) Attributes</strong> – facilitators had a role to play in influencing the approaches taken by groups.</td>
<td>Disciplined Inquiry – knowledge was integrated with in-depth understandings to go beyond reproduction of information to novel understandings</td>
</tr>
<tr>
<td>Idea Formation and Initial Research</td>
<td><strong>Situatedness</strong> – the cognitive demands and practices engaged resemble/reflect a process of scientific inquiry</td>
<td>Instructor as Facilitator – facilitators mediated the actions group’s took in progressively completing the project, suggesting next steps/approaches</td>
</tr>
<tr>
<td>Division of Work &amp; Continued Research</td>
<td><strong>Mediation</strong> – processes of research made use of literature, online tools, and collaborative tools</td>
<td>Situated Authentic Context – students were engaging in a process of inquiry that is peripherally legitimate to a community of practice in scientific inquiry</td>
</tr>
<tr>
<td>Presentation Development &amp; Rehearsal</td>
<td><strong>Embodiment</strong> – students embodied ideas developed through their inquiries in planning for and giving the presentation</td>
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<tr>
<td>Presentation</td>
<td><strong>Distribution</strong> – responsibilities and knowledge was shared between group members</td>
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<tr>
<td>Human Relationships</td>
<td><strong>Construction of Knowledge</strong> – students organized, interpreted, and evaluated their prior knowledge to solve new problems</td>
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<tr>
<td>Construction of Knowledge</td>
<td><strong>Disciplined Inquiry</strong> – knowledge was integrated with in-depth understandings to go beyond reproduction of information to novel understandings</td>
<td></td>
</tr>
<tr>
<td>Construction of knowledge as mediated by students’ interests. Knowledge construction both shapes and is shaped by research question. Construction of knowledge upon presentation.</td>
<td><strong>Situated Authentic Context</strong> – knowledge was built upon in a process of thinking that reflects elements</td>
<td></td>
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<tr>
<td>C Creative Expression</td>
<td>Program – creativity was emphasized as a critical curricular element of the project, leading to creative presentations</td>
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<td></td>
<td>Motivation – students were motivated by their interests, which were used to inform construction of knowledge</td>
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<td></td>
<td>Situatedness – learning became contextually welded to the storylines developed for creative expression of ideas and inquiries</td>
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<td>Mediation – through presentation, groups conveyed stories via use of language and props</td>
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<td>Embodiment – storytelling involved the use of one’s body as a vehicle for conveying what was learned</td>
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<td>Multiple Literacies – presentations reflected elements of linguistic, musical, spatial, and bodily-kinesthetic ways of knowing</td>
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<td>Motivation – students were motivated to complete and give the presentation</td>
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<td></td>
<td>Disciplined Inquiry – novel interpretations that could not have been retrieved from an existing database were expressed through creative means</td>
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</tbody>
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<thead>
<tr>
<th>D The Inquiry Project as Unique</th>
<th>Program – student-led action was emphasized as a critical curricular element of the project, leading to increased autonomy</th>
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</thead>
<tbody>
<tr>
<td>Increased Autonomy</td>
<td>Identity – learners feel a sense of self in learning</td>
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<tr>
<td>Facilitators Role</td>
<td>Teacher (Facilitator) Attributes – the facilitators roles in promoting increased autonomy are reflective of their characteristics</td>
</tr>
<tr>
<td>Question Posing</td>
<td>Distribution – understandings of roles and responsibilities shared between group members and facilitators</td>
</tr>
<tr>
<td>Feelings of Uncertainty</td>
<td>Construction of Knowledge – learners were stimulated to take autonomous approaches to formulating ideas and knowledge</td>
</tr>
<tr>
<td></td>
<td>Disciplined Inquiry – novel interpretations were developed through autonomous and student-driven thought</td>
</tr>
<tr>
<td></td>
<td>Instructor as Facilitator – facilitators played a key role in promoting increased student autonomy in learning</td>
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<td></td>
<td>Fostering Interests</td>
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<td></td>
<td><em>Interests as emphasized by facilitators.</em></td>
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<td></td>
<td><em>Encouraging and supporting one another’s interests.</em></td>
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<tr>
<td></td>
<td><em>Conveying interests.</em></td>
</tr>
</tbody>
</table>

**Embodiment** – feelings of uncertainty reflect how students were drawing upon their feelings and learning through bodily senses

**Motivation** – learners were motivated by the increased sense of autonomy over their learning

**Program** – a focus upon interests was emphasized as a critical curricular element of the project

**Teacher (Facilitator) Attributes** – the facilitators roles in promoting increased autonomy are reflective of their characteristics

**Situatedness** – learning came to be contextually situated within the real life context of student-based interest, as drawn from the world they knew beyond the classroom

**Embodiment** – a sense of students’ interests were integral to learning and students came to learn with and through the world they sensed around them

**Identity** – learners drew upon their personal interests and perspectives and saw themselves reflected in the project as a result

**Multiple Literacies** – asking oneself ‘what is interesting to me?’ is a form of intrapersonal understanding

**Human Relationships** – learners demonstrated a desire to be attentive to and support one another’s interests

**Motivation** – students were motivated by their interests

**Career Planning** – interests were oftentimes borne out of students academic and career goals,

**Disciplined Inquiry** – drawing upon interests, students asked pertinent and complex questions that were then explored to reach novel understandings

**Construction of Knowledge** – learners were stimulated to draw upon their interests for learning, influencing the way in which ideas and knowledge were formulated

**Instructor as Facilitator** – facilitators played a key role in emphasizing the importance of interests in informing groups’ inquiries

**Lived Experiences** – reflects an orientation towards authentic learning based upon students’ lived experiences

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|   | The Inquiry Project as Unique Memorization to Application. | Program – the application of learning a result of the enacted curriculum  
**Situatedness** – learning came to be contextually situated within the real life contexts found beyond the classroom  
**Mediation** – physical and social tools (i.e. media and news) were often the focus of applied understandings  
**Embodiment** – learners demonstrated application of developed understandings to world around them, taking this new ability to apply what they had learned with them as part of their way of knowing  
**Distribution** – knowledge became shared with a community of understanding  
**Identity** – learners framed application of understandings in context of what they found interesting and useful to them  
**Multiple Literacies** – asking oneself ‘how is this applicable to me?’ is a form of intrapersonal understanding  
**Motivation** – students were motivated by the application of their interests  
**Career Planning** – applications of learning related to students’ future studies and/or career interests. | Disciplined Inquiry - learners moved beyond reproduction of information to apply the knowledge they had assembled and interpreted by way of critique.  
Situated Authentic Context – students were engaged in cognitive apprenticeship of academic and research-based thinking that places emphasis on application over memorization  
Lived Experiences - Elements relate to the orientation towards authentic learning based upon students’ lived experiences |
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<tr>
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<tbody>
<tr>
<td>G</td>
<td>The Inquiry Project as Unique Applicability and Relevancy. Developing Skills Applicable to Future.</td>
<td>Program – curricular elements such as the personal goals and peer evaluation components placed emphasis upon transferrable skill development as a part of learning</td>
</tr>
<tr>
<td>Topic as Connecting Anatomy to Society. Expressing Science.</td>
<td>Situatedness – learning came to be contextually situated within the real life contexts found beyond the classroom. Embodiment – learners demonstrated application of developed understandings to world around them, taking this new ability to apply what they had learned with them as part of their way of knowing. Identity – learners framed application of understandings in context of what they found interesting and useful to them. Multiple Literacies – asking oneself ‘how is this applicable to me?’ is a form of intrapersonal understanding. Motivation – learners were motivated by the perceived value of this project in the way they were able to develop skills related to their ongoing development. Career Planning – learners were developing skills applicable to their future studies, careers, and lives.</td>
<td>Situated Authentic Context – students came to understand and express science in a way that more accurately reflects the disciplinary culture of practice.</td>
</tr>
</tbody>
</table>

| Learning as Interconnected with a Complex World Stress. | Embodiment – drawing upon and incorporating feelings and bodily knowing to inform learning. Identity - drawing upon and incorporating learners’ identities of themselves as undergraduate students and the feelings that arise from that. Multiple Literacies – intrapersonal intelligence. Human Relationships – learners demonstrated a desire to engage with their peers through opening up and sharing in their academic stress with one another. | Lived Experiences – learning was oriented in students’ lives, students’ identities of themselves, and the emotions related to their reality. |
| I | **Working Together**  
*Moving back and forth between working together and working independently. Working together by talking. Working together by coming together.* | **Support Network** – students turned to one another in coping with academic stress | **Situated Authentic Context** – the group work nature of the project reflected a common reality of the community of practice – that academics and researchers often collaborate and co-create |
| J | **The Inquiry Project as Unique**  
*Group work.* | **Program** – group work was emphasized as a critical curricular element of the project  
**Distribution** – theme reflects cognitive and social distribution in the way that work and knowledge came to be shared between members and with social tools. There were signs of the ‘residue left by thinking’  
**Mediation** – a variety of tools ‘participated’ in the process of working together – language, physical, and online tools for collaborating, in particular  
**Multiple Literacies** – elements of interpersonal and intrapersonal intelligences, as well as digital intelligences | **Situated Authentic Context** – the group work nature of the project reflected a common reality of the community of practice – that academics and researchers often collaborate and co-create |
| K | **Learning as Interconnected with a Complex World**  
*Being Social.*  
*Getting to Know One Another.*  
*Sharing in Struggles as Students.*  
*Socializing.* | **Identity** – learners drew upon the struggles they felt as students, understanding themselves in their role and sharing this understanding with others  
**Multiple Literacies** - elements of interpersonal and intrapersonal intelligences  
**Human Relationships** – learners tended to express a desire and preference for working with others | **Lived Experiences** – students’ lives and the people they interact with socially became very much a part of learning |
| Learning as Interconnected with a Complex World | Motivation. | Situatedness – learners were motivated by the way in which they saw their learning tied to the context of their interests and world around them |
| - | - | Identity – learners were motivated by the way in which they could see themselves reflected in the project |
| - | - | Embodiment – students were motivated by the learning environment, which was contextualized in their interests |
| - | - | Motivation – elements of this theme tie directly to the factor of motivation and considerations of competence, autonomy, self-efficacy, interest, relatedness, and control over learning |
| - | - | Career Planning – learners were motivated by the relationship between their interests, career goals, and aspects of the project that allowed for development |
| - | - | Human Relationships – learners were motivated by their preference to work with their group mates |

| Others |
| Support Network – supporting one another in the struggles as students |

Lived Experiences – motivations were driven by students’ contextualized interests as drawn from the world around them.

Situated Authentic Context – the motivational factors influencing students throughout the Inquiry Project reflect aspects of the motivational factors commonly stimulating work in an academic or research driven profession.