REMEDIATION TRENDS IN AN UNDERGRADUATE ANATOMY COURSE AND ASSESSMENT OF AN ANATOMY SUPPLEMENTAL STUDY SKILLS COURSE

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Dedication

This dissertation is dedicated to my parents. They have continuously supported me in my endeavors, always encouraging me to reach for the stars. I cannot fully express how much love and gratitude I have for them.

This dissertation is also dedicated to my roommate, running partner and best friend, Sadie. Coming home to a wagging tail never ceases to brighten my day and I cannot imagine having to complete this process without her.

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Abstract

Audra Faye Schutte

REMEDIATION TRENDS IN AN UNDERGRADUATE ANATOMY COURSE AND ASSESSMENT OF AN ANATOMY SUPPLEMENTAL STUDY SKILLS COURSE

Anatomy A215: Basic Human Anatomy (Anat A215) is an undergraduate human anatomy course at Indiana University Bloomington (IUB) that serves as a requirement for many degree programs at IUB. The difficulty of the course, coupled with pressure to achieve grades for admittance into specific programs, has resulted in high remediation rates. In an attempt to help students to improve their study habits and metacognitive skills Medical Sciences M100: Improving Learning Skills in Anatomy (MSCI M100) was developed. MSCI M100 is an undergraduate course at IUB which is taught concurrently with Anat A215, with the hopes of promoting academic success in Anat A215.

This multifaceted study was designed to analyze the factors associated with students who remediate Anat A215, to predict at-risk students in future semesters, and assess the effectiveness of MSCI M100. The first facet involved analysis of Anat A215 students' demographic information and class performance data from the spring semester of 2004 through the spring semester of 2010. Results of data analysis can be used by IUB instructors and academic advisors to identify students at risk for remediating, as well as provide other undergraduate anatomy instructors across the U.S. with potential risk factors associated with remediation.

The second facet of this research involved analyzing MSCI M100 course assignments to determine if there are improvements in student study habits and

metacognitive skills. This investigation involved quantitative analysis of study logs and a learning attitudes survey, as well as a thorough inductive analysis of students' weekly journal entries. Lastly, Anat A215 exam scores and final course grades for students who completed MSCI M100 and students who did not complete MSCI M100 were compared. Results from these analyses show promising improvements in students' metacognition and study habits, but further research will better demonstrate the efficacy of MSCI M100.

Valerie Dean O'Loughlin, Ph.D., Chair

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Chapter 1: Introduction

While students typically strive to do well in undergraduate coursework, some classes may be more challenging than others for students. Certain courses also cause additional stress because they are prerequisite for admission into professional programs. This dissertation examines one of these challenging courses in the hopes of improving student success rates.

Success in Anatomy A215

Academic success in anatomy and physiology is crucial for undergraduate students interested in health care professions. Acceptance into health care professional programs is partly dependent on successful student performance in these courses. Students must develop an adequate understanding of the structures of the body and how they function in order to succeed in their chosen field. Inadequate study habits, poor initial preparation, and a lack of confidence in one's abilities are important indicators of students at high risk of performing poorly in undergraduate coursework (Scalise, Besterfield-Sacre, Shuman, & Wolfe, 2000a).

Anatomy A215: Basic Human Anatomy (Anat A215) is an undergraduate human anatomy course at Indiana University Bloomington (IUB) that serves as a requirement or prerequisite for many degree programs at IUB. It is a large (400+ enrollment) lecture course which includes a laboratory component that is taught by graduate or medical student associate instructors. The course is composed largely of pre-nursing and pre-allied health students. The course covers a vast amount of complex material, increasing the difficulty of the course. The difficulty of the course, coupled with pressure to achieve grades for admittance into specific programs, has resulted in a withdrawal rate between

8% and 13% (O'Loughlin, 2002). Thus, a portion of each class contains students remediating the course because the student previously withdrew or did not obtain the desired/required grade in an earlier semester.

Supplemental Instruction & MSCI 100

Anatomy and other science courses are considered to be particularly challenging, and this has led some instructors to develop supplemental instruction (Arendale, 1994; Belzer, Miller, & Shoemake, 2003; Blanc & Martin, 1994; Bronstein, 2008; Hopper, 2011; Sawyer, Sylvestre, Girard, & Snow, 1996). Supplemental instruction (SI) allows students to not only receive help with course material, but they are also taught study skills as they relate to the material being covered (Blanc & Martin, 1994).

Medical Sciences M100: Improving Learning Skills in Anatomy (MSCI M100) is an undergraduate course at Indiana University Bloomington that serves as a supplement to Anat A215. This course was developed in 2012 by two graduate students, including the author (Audra Schutte), with the goal of helping students (especially those remediating Anat A215) improve their study habits and metacognitive skills. Enrollment in MSCI M100 is voluntary, and this course is taught in conjunction with Anat A215, with the hopes of promoting academic success in Anat A215.

Research Questions

In an attempt to analyze the factors associated with students who remediate Anat A215, which could then be used to predict at-risk students in future semesters, and assess the effectiveness of an anatomy study skills course, the following multi-faceted dissertation research was conducted. The first facet of this research involved analysis of Anat A215 students' demographic information and class performance data from the

spring semester of 2004 through the spring semester of 2010. These data included age, gender, ethnicity, major of study, SAT and ACT scores, A215 lab and lecture exam scores, A215 total points earned (and letter grade received), the number of times an individual took Anatomy A215. For the purposes of this research, students were referred to as remediators or non-remediators. *Remediators* are students who have been enrolled in Anat A215 two or more times, including those students who withdrew after the first full week of the semester, and *non-remediators* are those who have only been enrolled in Anat A215 once during the study timeframe. Analysis of these data will potentially aid the IUB instructors in identifying students at risk for remediating and providing those students with necessary assistance to succeed in Anat A215. The first part of this research addresses the following questions:

- Are there particular majors or programs whose students are more likely to remediate Anat A215?
- Is there a gender bias for individuals who remediate Anat A215?
- Are students of certain age groups at greater risk for remediating Anat A215?
- Are students of certain ethnic backgrounds more likely to remediate Anat A215?
- How do remediating students' exam scores and final course grades compare to students who successfully completed anatomy without remediation?
- How do remediating students' exam scores and final course grades compare to their scores and final grade after the first time in Anat A215?

- Do remediating students have lower SAT scores than non-remediating students?
- Is the length of time between the first and second time enrolled in Anat A215 related to success of remediating students?

This data analysis can provide undergraduate anatomy instructors across the U.S. with valuable information about potential risk factors associated with remediation. Thus, while the remediation data is specific to anatomy at IUB, the analysis of this data should yield information useful to multiple undergraduate anatomy courses at other colleges and universities.

The next facet of this research involved analyzing MSCI M100 course assessments. Several course assignments were analyzed to measure improvements in study habits and metacognition. This investigation included an inductive approach, grounded in the data, to analyze students' weekly journal entries. Quantitative analysis was conducted to assess study logs, and to compare Anat A215 exam scores and final course grades for students who completed MSCI M100 and students who did not complete MSCI M100. Also analyzed were results of a survey administered to capture students' skills and behaviors related to learning before and after completion of MSCI M100 and Anat A215. These course assignments and results of this survey were analyzed to address the following questions:

- Do students enrolled in MSCI M100 achieve higher exam scores and final course grades in Anat A215 than students not enrolled in MSCI M100?
- Do MSCI M100 students demonstrate improved metacognitive awareness after completion of the course?

- Do M100 students' study habits change throughout and after completion of the course?

The upcoming chapter discusses the current literature on learning theories, metacognition, remediation in anatomy and other disciplines, supplemental learning programs and anatomy instruction at undergraduate and graduate levels. Chapter 3 presents the methodology, results and discussion of the analysis of the factors associated with students who remediate Anat A215. Chapter 4 discusses the development and pilot of the supplemental course, MSCI M100. This chapter also includes discussion of how the course has evolved from the pilot. In chapter 5, the methods, results and discussion of the analysis of several MSCI M100 course assignments are discussed. Analysis of one regular course assignment in MSCI M100 was extensive, and warranted discussion in its own chapter. Therefore, chapter 6 discusses the development of a codebook which was used to analyze blogs completed by MSCI M100 students. Also described in this chapter are the results and discussion of this analysis. Finally, chapter 7 discusses overall conclusions drawn from this research. This includes implications for students, instructors, and academic advisors, as well as directions for future research.

Chapter 2: Learning and Metacognition in Anatomy

How students learn has been explored by numerous researchers, and many different theories have been developed in an attempt to explain the learning process. This chapter will begin by describing the general categories of learning theories (sociocultural and cognitive) and the defining features of these theories. Following this discussion will be examples of how those theories may be applied to anatomy students. Metacognition, which is simply defined as how we monitor our own thought processes, is a key aspect of cognitive learning theories and is a focus of this study (Veenman, Van Hout-Wolters, & Afflerbach, 2006). Because of the emphasis on metacognition, it will be more thoroughly discussed than other aspects of cognitive theories.

Following the introduction to theories of learning, the discussion will move into descriptions of remediation and factors associated with student success in undergraduate education. Remediation will also be explained in the context in which it often applies to anatomy education, as this is the way it will be used in the present study. Colleges and universities have implemented a variety of resources and programs to add students who are struggling, and one widely used program is Supplemental Instruction (SI) (Arendale, 1997; Bronstein, 2008). The various components of SI will be described, and this chapter will end with a discussion of how anatomy is taught at graduate and undergraduate levels.

Learning Theories & Anatomy

Many theories address the wide array of topics associated with learning. Theories have been generally labeled by their unit of analysis and the issues addressed by the theory. However, it should be noted that a single theory is not able to include every possible factor in learning. Learning theories can be broadly categorized as either

sociocultural or cognitive theories. Sociocultural learning theorists analyze how an individual's interaction with other individuals and their environment impacts the learning process (John-Steiner & Mahn, 1996; Packer & Goicoechea, 2000; Siegler, DeLoache, & Eisenberg, 2005). Cognitive learning theorists emphasize the learning process as it occurs within an individual, how new information is retained and how it relates and shapes prior knowledge (Shuell, 1986; Siegler et al., 2005; Terrell, 2006). Each theory type emphasizes important components of learning; yet no one theory will adequately address every issue related to learning. Some seem to view cognitive and sociocultural theories to be in conflict, but perhaps these theories should be considered complements to each other, as each addresses important aspects not covered by the other.

Sociocultural theorists have examined learners in a variety of communities (in and out of classrooms), how cultural beliefs and norms affect learning, as well as implications for teaching and instructional methods (Greeno, 2006; Hodson, 1999; John-Steiner & Mahn, 1996). The goals of these communities can shape what its members deem to be important and how its members learn (Roth & Lee, 2004). Communities can also help instructors to provide context for students. From a sociocultural perspective, one component of the instructor's role is to model how to think through such contexts; this method is referred to as scaffolding (Ge & Land, 2003; Hodson, 1999; Pea, 2004). The scaffolding method may be described as follows: early on instructors provide more assistance, but as the semester progresses, students require less and less guidance to effectively master the subject.

These aspects of sociocultural theories can be seen in an undergraduate anatomy course. Many undergraduate anatomy students are hoping to pursue a career in an allied

health field. These students are often in several classes together, leading to formation of their own small communities with common interests. Anatomy course material may be presented in the context as it relates to illnesses or injuries that the students may one day encounter in their careers or personal lives. Such illnesses and injuries could be used by the instructor to create opportunities for scaffolding. The instructor can help students develop critical reasoning skills using their anatomical knowledge to develop differential diagnoses and explanations for a given diagnosis. The instructor would provide more structured assistance with such problems in the early part of the semester. As the semester progressed the instructor's guidance would be gradually reduced, giving the students the opportunities to practice using their skills/knowledge.

One of the hallmarks of a cognitive learning theory is its emphasis on the creation and modification of mental models, or schema, within the individual. These schemata are key components needed to successfully solve problems (Merrill, 2000; Siegler & Alibali, 2004). This schema may be quite developed or rather limited; either way, it helps students to encode and make sense of new information (Bruer, 1994; Terrell, 2006). As information is presented in class, a student's schema will be embellished and adjusted in some areas. A task for science educators is not only to help students develop accurate mental models, but to generate meaningful patterns within those models. Those patterns help reach a deeper understanding of the material, much like that of experts in the field. The experts' deeper, more meaningful and organized schemata allowed them to move beyond the surface features of the problem and more efficiently utilize deeper features in reasoning (Bransford, 2000; Bransford et al., 2005; Bybee, 2002).

As students process new information, they will likely encounter subject matter that contradicts one or many of their conceptions already held about the human body. Misconceptions are often discussed from a cognitive perspective. Students may hold misconceptions which fall short or even completely fail to accurately explain a given phenomenon (Bybee, 2002; Posner, Strike, Hewson, & Gertzog, 1982; Smith III, diSessa, & Roschelle, 1994). Such misconceptions present a challenge to instructors, because although these conceptions are inaccurate, students hold onto them quite strongly (Bybee, 2002; Savion, 2002; Smith III et al., 1994). One such example comes from the Private Universe Project in 1989, in which interviews of Harvard graduates and faculty members demonstrated they held many of the same misconceptions held by children. When asked to explain why we have seasons, 21 out of 23 interviewees were unable to give an accurate explanation (Novak, 2002). Despite being highly educated, these people held onto misconceptions that resulted in them being unable to explain a concept taught in grade school.

In anatomy, students enter the class with an established schema of the human body that will be modified and adjusted as the class progresses. However, an anatomy student, essentially a novice anatomist, lacks the well-developed schema of an expert anatomist. To better develop students' novice schemata into a more expert-like schema, they must make appropriate connections between ideas so that more meaningful patterns of information emerge (Bransford, 2000). Additionally, students typically have some preliminary knowledge about the human body and diseases that can afflict it, but there are often existing misconceptions in this knowledge. For example, most students have heard of appendicitis and know that it can be quite painful. They also know that the

appendix is often removed prior to it rupturing to prevent infection in the individual's abdominal cavity. Students conceive that an organ (the appendix) that can be so problematic must be large. When they see the appendix for the first time they are surprised to see such a tiny structure. Another example deals with the oxygen levels of the blood in arteries and veins and the color coding of blood vessels on models or in images. Arteries are typically red (indicating high oxygen levels in the blood), while veins are typically blue (indicating low oxygen levels). It is not unusual for students to hold the conception that all arteries carry oxygenated blood, while veins carry deoxygenated blood. This leads them to assume that all red blood vessels are arteries and all blue vessels are veins. Yet, in the pulmonary circulation, arteries are carrying deoxygenated blood and colored blue, while veins carry oxygenated blood and colored red.

Posner, Strike, Hewson and Gertzog (1982) view learning as a process of conceptual change. They argue that in order to change a person's misconception, the new theory must be intelligible and plausible. In the example of the appendix mentioned above, in addition to showing students an actual appendix, providing an intelligible reason for its potential to wreak havoc in the abdomen (despite its small stature) can help students correct their misconceptions. In the blood vessel example, it takes a great deal of discussion about the function of pulmonary circulation versus systemic circulation to help students correct the generalized conception(s) they hold about arteries and veins and how those vessels are shown on models or in images.

Metacognition

An important aspect of many cognitive theories is an individual's knowledge of cognition in general and regulation of their personal cognitive processes, collectively referred to as metacognition (Bransford, 2000; Flavell, 1981; Veenman et al., 2006). Simply put, metacognition is thinking about thinking. For example, when a student is studying for an exam and reads a paragraph in a textbook, metacognition is what enables to them recognize that they understand the reading or that a term doesn't make sense. Flavell (1981) describes a model of cognitive monitoring in which our cognitive goals, metacognitive experiences, metacognitive knowledge and cognitive actions are in continuous interplay with each other, helping us to assess if we adequately understand information. The various factors that impact and are influenced by metacognition have been widely studied, but for the purposes of this dissertation only a brief overview of these topics is included.

Students do not always enter college with well-developed metacognitive skills. However, teaching practices, course goals and assessment methods can help facilitate the use of deep approaches to learning (Ross, Green, Salisbury-Glennon, & Tollefson, 2006). At a school of medical science in Australia, instructors in an anatomy and physiology course for 282 first year university students set out to assess their students' metacognitive awareness (Naug, Colson, & Donner, 2011). Students completed an activity in class in which all prompts (texts, models, etc.) were removed, and students were required to reconstruct a concept purely from their own knowledge. On their first attempt at this activity, 80 percent of the students were unable to complete it without guidance from a textbook. Most students commented that they were surprised by their lack of knowledge,

leading the researchers to the conclusion that most students experience a discrepancy between what they perceive they know and the actual extent of their knowledge.

The relationship between the various aspects of metacognition and academic success has been addressed by numerous researchers. Self-regulated learning, the utilization of various cognitive and metacognitive skills to successfully complete academic tasks, was found to have a significant positive correlation with grade point averages of 160 undergraduates at a medium-sized Midwestern university (Lindner & Harris, 1992). Such a relationship is supported by findings that students who are failing courses seem to be ineffective monitors of their own learning, spending inadequate time on material they don't understand and not realizing if their study strategy works only until after taking an exam (Garrett, Alman, Gardner, & Born, 2007). Similar trends are apparent even in younger students. In addition to higher levels of confidence in their abilities, students from a highly selective school in New York City in the 5th, 8th and 11th grades demonstrated greater efforts to strategically regulate learning than students at regular schools (Zimmerman & Martinez-Pons, 1990).

Despite the relationship demonstrated by those studies, it should not be assumed that struggling students lack the ability to become better monitors of their learning. There are modest correlations between intelligence and metacognition, but there is evidence suggesting sufficient metacognitive abilities may compensate for an individual's cognitive limitations (Veenman et al., 2006). For example, when asked to solve a non-standard chemistry problem, a pair of undergraduate students' successful self-monitoring of the problem-solving process led them to a correct answer, despite their lack of experience with the material. In contrast, a graduate student with much greater

content knowledge, but who lacked metacognitive skills, failed to correctly solve the problem (Rickey & Stacy, 2000).

Examination of students with stronger metacognitive abilities has also revealed a positive correlation with self-efficacy, which is an individual's belief in their own abilities to successfully perform a given task (Garcia & Pintrich, 1991; Papinczak, Young, Groves, & Haynes, 2008). Similar to metacognition, self-efficacy has also consistently been shown to be positively correlated with academic success (Andrew, 1998; Bandura, 1993; Fazey & Fazey, 2001; McKenzie & Schweitzer, 2001; Zimmerman, Bandura, & Martinez-Pons, 1992). Andrew (1998) developed a survey assessing nursing students' self-efficacy in first-year undergraduate nursing program science courses. The pilot of this survey generated statistically significant positive correlations linking self-efficacy to students' overall score in two general science courses, the first of which covered physics and chemistry that relate to nursing and the second course provided an introduction to biological function of the body. Andrew (1998) suggests that it is possible that with further examination, a survey such as this may someday be used to identify students at risk of failing or withdrawing from science courses. Similar results were found when analyzing the relationship between several variables and overall academic performance of first-year Australian university students. Students with higher self-efficacy had significantly higher grade point averages than students who reported lower self-efficacy (McKenzie & Schweitzer, 2001).

While these results are useful, it is important to consider that students' confidence in their abilities to succeed is not necessarily reflective of their actual intellectual abilities. Students may lack the confidence in their abilities to meet the demands of

higher education even though they possess the capabilities to be successful (Fazey & Fazey, 2001). Low self-efficacy can have a negative effect on other factors associated with academic success, such as decreased motivation and increased anxiety about achievement (Bandura, 1993). Bandura stated, "It is difficult to achieve much while fighting self-doubt" (1993, p. 118).

As this and other research shows, metacognition and self-efficacy have positive correlations with academic success. Still, there are a number of other factors influencing students' abilities to succeed in undergraduate coursework. Several of these variables will be more thoroughly addressed in the remediation section of this chapter.

Predicting Academic Success

A number of studies have been conducted to determine which factors can help identify students who might be at risk for remediation. Closely related are those studies which explore factors that may be most closely associated with academic success. Understanding these factors can allow for improvements in already established remedial courses, and aid the development of new interventions to promote success for all students.

A study of college freshman enrolled in anatomy and physiology at the University of Minnesota revealed several factors to be predictive of academic success in the course. Students with higher ACT scores and those who performed well on a quiz given in the second week of class (covering the first week's material) were more likely to perform well in the course. Likewise, students performing poorly on this initial quiz subsequently performed poorly in the course (Jensen, Moore, & Connor, 2007). While it is not surprising that students who do well on the initial quiz proceed to do well in the course,

additional research is necessary to understand what variables are most influential on a student performing well.

Although some research has shown a link between standardized test scores and academic success, others have found no correlation. A study of undergraduate students at La Trobe University in Australia established that scores on a standardized exam (Equivalent National Tertiary Entrance Rank) used to rank students for entry into university courses was important in predicting student performance in physiology and biomechanics subjects, but they were unimportant for anatomy (Green, Brown, & Ward, 2009). The researchers concluded that success in anatomy may be reliant upon abilities not captured by entrance exams.

An assessment of undergraduate engineering students at the University of Pittsburgh School of Engineering revealed that a lack of adequate study habits and confidence are factors affecting students' success in their coursework (Scalise, Besterfield-Sacre, Shuman, & Wolfe, 2000b). Use of a study skills inventory is a potential method for instructors to use for identification of students with inadequate study skills so that they can be advised on how to improve upon their current skill set (Tait & Entwistle, 1996).

Remediation

Examination of the literature on post-secondary remediation, often referred to as basic skills education, focuses primarily on the remediation of students entering college with below college-level reading, writing and mathematics skills (Bahr, 2008; Bahr, 2010; Bettinger & Long, 2009). A seemingly growing number of students are entering college without adequate skills to successfully complete undergraduate coursework (Boatman, Long, & Research, 2010). Universities have responded by offering remedial

courses which serve as a pre-requisite for college-level coursework. Students are placed in these courses based on standardized test scores and/or placement exams, and such courses aim to provide students basic knowledge and skills so that they can succeed in college-level coursework (Aud et al., 2011; Bahr, 2010). In the 2007-2008 academic year, 39 percent of first year undergraduate students from a sample which includes 4-year public institutions in all 50 states, the District of Columbia and Puerto Rico reported having taken at least one remedial education course during their first year of college (Aud et al., 2011).

The growing number of entering undergraduate students who require remedial education raises several questions, one of which is whether or not college remediation works. Research has revealed a mixture of results, although the majority of these results have been positive. Boatman, et al. (2010) found mixed results of remediation in mathematics, reading and writing on student success and persistence in public two and four-year colleges in Tennessee. Those students who were on the borderline of needing remediation prior to entering college level courses suffered negative effects (lower grades and decreased credit accumulation) of remediation, while students with a greater need for remediation yielded positive results such as higher credit accumulation and degree completion (Boatman, et al., 2010).

A longitudinal analysis of nearly 86,000 community college students in California revealed that students who successfully remediate math reach levels of attainment that are comparable to students who achieve college math skill without remediation (Bahr, 2008). This result is promising for students who remediate successfully, but the same study also showed that 75 percent of remedial math students did not successfully remediate (Bahr,

2008). Further analysis of these remedial students revealed that students entering remediation with a lesser deficit in their math skills were more likely to successfully remediate, while students with a greater skill deficit were less likely to complete the remediation successfully. This study demonstrates that remediation can be very effective for some students, but continued research is necessary to understand the factors impeding the majority of students from successful remediation.

Analogous results were found in a study of a similar cohort of community college students in California requiring math and English remediation. Students who successfully remediated in both areas were able to reach similar attainment levels as students who reached college-level skill without remediation. Still, 58 percent of skill-deficient students did not successfully remediate (Bahr, 2010). The positive results of math and English remediation are supported by results from a study of over 28,000 students from public Ohio colleges. The researchers found that students who completed remediation had better educational outcomes, such as increased retention rates and degree attainment, than students with similar backgrounds who were not required to enroll in remedial coursework (Bettinger & Long, 2009). Again, these results are promising for students who are able to remediate successfully, but over half of the students were not successful. It is important for additional research to determine why the majority of students are not remediating successfully and what can be done to increase the success of these students.

Anatomy Remediation

The previous discussion of remediation is in the context of identifying and assisting students who are at risk of struggling with college-level coursework as they

enter college. Discussion of remediation in undergraduate anatomy courses, and throughout the remainder of this dissertation, refers to students re-taking a portion of a course or the entire course. This particular form of remediation has been explored more frequently in the context of undergraduate courses such as biology or chemistry, or in medical school coursework in an attempt to understand who is at risk for remediating and discussing successful methods of remediating (Scalise et al., 2000b; Slotnick, 1981). Even so, there is a dearth of literature regarding anatomy remediation at the undergraduate level.

Although most medical students have been successful throughout their academic careers, some enter medical school with deficiencies in their study skills, such as inadequate background, lack of confidence, low-order cognitive skills, resulting in a need for remediation. After taking a pre-test, medical students at the University of North Dakota were provided with supplemental instructional materials, which was shown to be useful to students with and without deficiencies, to improve in areas of anatomical terminology (n=66) and applied mathematics (n=51) on a post-test (Slotnick, 1981). While encouraging, the time frame between pre and post-tests ranged between a few hours to a few days, depending on when the student completed reviewing the supplemental materials. If a student performs poorly during a semester-long course, it may not be feasible for an instructor to provide additional materials and re-test the student due to time limitations and the need to move on to new information.

Remediation more typically occurs after a student has performed poorly in an entire course. Occupational therapy, physician's assistant and physical therapy students at the University of New England who were at risk for failing their anatomy course were

given an opportunity to remediate their lowest set of examination grades (Daly, 2010). Students who would not pass the course, even with earning 100 percent on a remedial exam, were required to repeat the entire course. Students remediating their lowest exam (n=32) were given 1-4 weeks to re-study material, after which they were given a multiple choice exam and an electronic practical exam which contained high-resolution atlas images. There was an average increase of 9.7 percent on multiple choice exam scores and a 20.4 percent increase on the practical exam. Seventy five percent (n=24) of remediating students were able to pass the course, demonstrating successful remediation of gross anatomy (Daly, 2010).

Instead of allowing students to remediate a lowest exam score, some institutions have developed supplemental courses aimed specifically at assisting remediation students when they re-enroll in a course. Students repeating anatomy and physiology at the University of Southern Indiana were required to take a supplemental course, which assisted students with course content and as well as how to study (Hopper, 2011). Three out of the five remediating students earned better grades in A&P (Hopper, 2011). One student, whose course grade improved by two letter grades, commented that participation in the supplemental course helped with raising the grade and "helped me be more organized, understand the material and put aside more time for study" (Hopper, 2011, p. 74).

At a Caribbean-based US medical school, 91 percent of the 216 medical students who failed the first year of medical school were able to successfully remediate after completion of a mandatory program which emphasized cognitive skill development and review of basic sciences (Winston, Van der Vleuten, & Scherpbier, 2010). Prior to the

implementation of this program, only 58 percent of repeating students successfully remediated the first year of medical school.

The enormous need for remedial coursework in math and reading is an indication that undergraduate students enrolled in difficult courses like anatomy, especially during the first year of college, are likely to struggle. There is a broad range of variables that appear to be indicative of students' academic success. Even so, successful remediation of undergraduate and graduate level students has been demonstrated in anatomy and other fields. Continued research of learning by anatomy students will hopefully help to better understand which factors are most influential on a students' success and how to successfully remediate all students.

Supplemental Learning Programs

Universities offer a range of support programs for students. For example, at Indiana University Bloomington students have access to academic support centers and programs which offer free tutoring, advising, and other academic support on campus, such as the Faculty and Staff for Student Excellence Mentoring Program (http://www.indiana.edu/~omsld/), Groups Student Support Services Program (http://www.indiana.edu/~groups/), and the Office of Mentoring Services and Leadership Development (http://www.indiana.edu/~omsld/). These offices and programs offer academic support in the form of mentors, as well as cultural and social activities to disabled, low-income and minority populations on campus. A variety of academic support programs have been made available to students at a variety of institutions. One such program that has been shown to be successful is Supplemental Instruction (SI). SI was developed at the University of Missouri-Kansas City (UMKC) nearly three decades

ago in an attempt to aid students in customarily difficult courses by helping them connect learning skills to the material being learned (Arendale, 1994; Blanc & Martin, 1994). SI aims to improve student performance and retention in traditionally challenging courses (courses with high failure and withdrawal rates) via a collaborative learning approach (Arendale, 1994; Blanc, DeBuhr, & Martin, 1983; Blanc & Martin, 1994).

The SI model developed at UMKC demonstrated such positive student outcomes that the program not only became widely used throughout the university; it is now utilized across the country (Arendale, 1994). SI is typically used for introductory courses taught in the first year or two of college with attrition and failure rates that are 30 percent or greater (Blanc & Martin, 1994; Etter, Burmeister, & Elder, 2001). SI is proactive, assisting students from the beginning of a course instead of a response to poor performance on the first examination. It is also important to note SI identifies high-risk courses, not high-risk students, which helps to remove any stigma that may be associated with remedial programs. In addition, student participation is voluntary (Bridgham & Scarborough, 1992). Students may attend as many sessions as they choose, and course instructors are not aware of who attends sessions until after the course is complete. Each session is led by a student(s) who has successfully completed the course in a recent semester. Sessions focus on integrating course material with learning and study strategies (Arendale, 1994; Blanc, DeBuhr, & Martin, 1983).

As previously mentioned, universities across the country have implemented their own SI programs for courses in science, mathematics, economics, history and other fields (Arendale, 1997; Etter et al., 2001; Zepke & Leach, 2005). In their review of SI programs for 132 introductory undergraduate accounting courses from 21 four-year

institutions, Etter et al. (2001) found that students who participated in SI earned higher average course grades, as well as lower failure and withdrawal rates. These findings match up with results of SI programs for courses in other fields, such as physiology, biochemistry, pharmacology (Blanc et al., 1983; Bridgham & Scarborough, 1992).

Students who enrolled in an upper-level undergraduate chemistry course and participated in its corresponding SI program were shown to have higher grades than the non-SI students, as well as decreased levels of anxiety and increased feelings of support (Bronstein, 2008). This particular study was also addressing perceptions faculty and students have about SI. Results showed that both faculty and students found SI to be valuable in achieving academic success.

Similar results were found at Kingston University in the United Kingdom. SI was implemented to assist students in computer science, engineering and electronics courses (Rye, Wallace, & Bidgood, 1993). A statistically significant difference in exam scores was found, in which students who attended five or more SI sessions for a particular course earned higher exam averages than students who did not attend SI sessions.

At some universities and colleges, instructors have developed courses that have desired student outcomes that closely reflect those of SI programs. At Idaho State University, a supplemental biology course was designed to improve students' study skills, critical thinking skills, self-esteem, metacognitive skills and content knowledge of biology (Belzer et al., 2003). This course was taught by doctoral students planning to become college science educators instead of an undergraduate student who completed the biology course successfully. Students who participated in the supplemental course

showed greater gains in content knowledge, greater motivation and lower failure rates in the original biology course than students not enrolled in the supplemental course.

Hopper (2011) designed a one credit-hour supplemental course at the University of Southern Indiana in an attempt to improve retention and success of students in anatomy and physiology. The supplemental course goals closely align with those of SI listed previously, although this course is taught by faculty instead of being student led. Additionally, the supplemental course was mandatory for any student repeating anatomy and physiology (optional for those students enrolled for the first time), whereas traditional SI courses are optional for any student (Arendale, 1994; Blanc et al., 1983). Similar to other researchers, Hopper (2011) found higher rates of success and retention in anatomy and physiology among the students who participated in the supplemental course.

Undergraduate students are not the only students to benefit from SI or SI-like courses. Although medical and graduate students must be successful in their undergraduate coursework in order to be admitted to their graduate programs, supplemental courses have been shown to benefit these advanced students. SI is offered to medical students enrolled in biochemistry and physiology at Michigan State University's College of Human Medicine. Researchers analyzed exam scores in these courses from a two-year time frame, which revealed that students who attended 80 percent of SI sessions for a course had higher exam averages than students who did not attend SI regularly (Bridgham & Scarborough, 1992).

First-year medical students at the University of Southern California Medical School had the option of enrolling in a modified SI program that was offered to assist students in gross anatomy, biochemistry, microanatomy and physiology (Sawyer et al.,

1996). Students selected up to two of these disciplines for which they would attend small-group discussions twice each week. Average test scores improved over previous years for the first and second exams in biochemistry and gross anatomy. Overall failure rates decreased significantly, particularly amongst academically "at-risk" students (students who earned $\leq$ 26 on the MCAT and with a GPA $\leq$ 3.0). The authors suggest that SI can serve as a bridge between undergraduate coursework and the more demanding medical school course load.

An academic support program was implemented at a Caribbean-based U.S. medical school to help medical students who are repeating first year medical coursework with the development of skills to be successful in medical school (Winston, Van der Vleuten, & Scherpbier, 2010). The program is similar to the supplemental course designed by Hopper (2011), as it provides assistance with content knowledge and aims to improve metacognitive skills, and the program is required for repeating students. Students work in groups to discuss various time management methods and study tips as well as talking through scientific content. Statistically significant results show that students completing the academic support program have been more successful than students who repeated the first year courses but did not complete the program. Of the 216 program participants, 91 percent made it to the second semester of coursework, and 79 percent reached the third semester. In contrast, only 58 percent of 715 students who did not complete the program made it to the second semester, and 47 percent of those reached the third semester (Winston et al., 2010).

Much of the research on SI has been focused on performance outcomes of students who regularly participate in sessions. One study demonstrated that the students

who lead SI sessions reap academic benefits, such as higher standardized test scores and GPA, than their peers who do not teach (Wong, Waldrep, & Smith, 2007). These studies have shown positive results within the courses for which SI has been developed. However, a longitudinal study which assesses potential long-term benefits of participating in SI could show whether or not students are able to effectively transfer the skills they learn in SI to future coursework in a similar or different discipline.

However, caution should be exercised when interpreting these studies. There is always potential for self-selection bias regarding who participates and who does not participate in SI. It is possible that students who voluntarily participate in SI are already more motivated than their peers who choose not to participate, making them more likely to succeed. It would be interesting to compare student populations and course outcomes of a voluntary SI course to a required course like the ones designed by Hopper (2011) or Winston et al. (2010). Although there are still questions to be answered about SI, the overwhelming success of these programs across disciplines suggests that they are worthwhile for students. Continuing to assess the various aspects of these programs will allow for ongoing improvement and success.

Past & Current Anatomy Instruction

The teaching of anatomy has not varied much until recent years. Traditionally, gross anatomy courses consisted of didactic lectures which were paired with laboratory sessions involving cadaveric dissection (Drake, Lowrie, & Prewitt, 2002; Minhas, Ghosh, & Swanzy, 2012; Sugand, Abrahams, & Khurana, 2010; Wright, 2012). This format is still common amongst medical school anatomy courses. Standardized testing for medical students helps to shape course curricula. In addition, some professional societies such as

the Human Anatomy and Physiology Society (HAPS; http://www.hapsweb.org) provide their members with suggested outlines for content in their courses, including suggestions for clinical applications of anatomy material to discuss (Committee, 2005).

In recent years there has been a push to utilize a wider variety of pedagogical methods in medical school and some undergraduate anatomy courses. It has become more and more common to see students working in small groups during lecture sessions and for lectures in general to take more of a learner-centered approach (Minhas et al., 2012; Prince et al., 2003). At some institutions, dissection has been replaced with 3-D imaging, plastic models and computer or web-based programs (Drake et al., 2002; Minhas et al., 2012; Sugand et al., 2010; Wright, 2012). Another change in recent years has been a decrease in the number of hours medical students spend in their anatomy courses (Drake et al., 2002; Drake, McBride, Lachman, & Pawlina, 2009). Curricular reform in medical education is taking place across the country, and IU School of Medicine is no exception. Several curricular changes have been made, resulting in a reduction of contact hours in gross anatomy from 142 to 126 on the Bloomington campus. This decrease coincides with a shift in the number of hours designated for activities such as team-based learning and problem-based learning versus traditional lecturing.

While course design and pedagogical issues are quite similar between professional/graduate and undergraduate anatomy courses, there are differences that instructors must consider. There is typically a lecture and laboratory component in both types of courses, but cadaveric dissection is rare in undergraduate courses. Factors such as cost, availability of donors, or proper facilities make it challenging for most

undergraduate courses to included dissection in their laboratory component (Wright, 2012). Therefore, undergraduate anatomy students typically study from plastic models, textbooks, or computer-based programs. Additionally, the student population in undergraduate courses is much more diverse than in medical gross anatomy in regard to student interests and career goals (Collier, Dunham, Braun, & O'Loughlin, 2012; Husmann, O'Loughlin, & Braun, 2009; Minhas et al., 2012; O'Loughlin, 2002), and time is a limiting factor for how much depth of material can be covered in undergraduate courses as well. Often little to no embryology and/or microanatomy is covered, and such courses are not often offered as a separate majors level course (Darda, 2010).

There also has been a push for more active learning in undergraduate anatomy and science courses in general. Active learning activities have been shown to increase student engagement in lectures (O'Loughlin, 2002), and they are useful for promoting better understanding and retention of material (DeHaan, 2005). Like anatomy, many undergraduate science courses have at least a large lecture component of the course, which is often utilized to allow instructors to efficiently convey large amounts of information to a large number of students (Tobias & Tomizuka, 1992). Despite a large number of students being enrolled, instructors can incorporate a number of activities to engage students in more active learning. Creating charts, discussing sample exam questions, associational brainstorming and debate are just a few of the many activities that have been shown to be successful at engaging students in large lectures (Frederick, 2002; O'Loughlin, 2002).

Anatomy A215 at Indiana University Bloomington

At Indiana University Bloomington (IUB), undergraduate students may enroll in Anatomy A215: Basic Human Anatomy (Anat A215). This is a one-semester course that serves as a requirement or prerequisite for many degree programs at IUB. It is a large (400+ enrollment) lecture course which includes a laboratory component that is taught by graduate or medical student associate instructors. Students take four multiple choice lecture examinations, and four laboratory examinations which focus on identification of anatomical structures on models, cadavers and histological slides. The course is composed largely of pre-nursing and pre-allied health students. The course covers a vast amount of complex material, increasing the difficulty of the course. The difficulty of the course, coupled with pressure to achieve grades for admittance into specific programs, has resulted in a withdrawal rate between 8 and 13% (O'Loughlin, 2002). Thus, a portion of each class contains students remediating the course because the student previously withdrew or did not obtain the desired/required grade in an earlier semester.

In order to assist repeating students and to reduce the number of students needing to repeat Anat A215, instructors must have a deeper understanding of the factors associated with these students. The upcoming chapter discusses analysis of demographic variables and Anat A215 exam and course grades. Specifically, trends associated with students repeating the course are discussed.

Chapter 3: Remediation in Anatomy A215

Anatomy A215: Basic Human Anatomy (Anat A215) is an undergraduate human anatomy course at Indiana University Bloomington (IUB) that is composed largely of pre-nursing and pre-allied health students. This course serves as either a requirement or prerequisite for many degree programs at IUB, including athletic training, nursing and physical therapy. It is a large (400+ enrollment) lecture course which includes a laboratory component taught by graduate or medical student associate instructors. Anat A215 is a systems-based anatomy course, covering a vast amount of complex material over one semester, which makes this course very challenging for the majority of students. Course grades are based on student performance on each of four lecture exams and four laboratory exams, and each exam is worth 100 points, totaling 800 points for the course. The difficulty of this course, coupled with pressure to achieve grades for admittance into specific programs, has resulted in a withdrawal rate between 8 and 13% for most semesters (O'Loughlin, 2002). Thus, a portion of each Anat A215 class contains students remediating the course because the students previously withdrew or did not obtain the desired or required grade in an earlier semester.

Predicting which students are at greatest risk for needing to remediate Anat A215 would potentially allow instructors to identify and assist at-risk students during their first enrollment so that remediation rates would reduce. For the purposes of this dissertation, **remediators** are those students who have been enrolled in Anat A215 two or more times. Remediators may have withdrawn from Anat A215 sometime after the first week of class or they may have completed the course and earned a final grade during their initial enrollment. It is important to note students who withdrew from the course during the first

week of classes are not included because they do not remain a part of the permanent roster). The vast majority of remediators enrolled in Anat A215 two times during the study time-frame. There were 27 students who enrolled in the course three times. These students will be referred to as **multi-remediators**. General descriptive statistics will be given for the multi-remediators, but this group will not be included in other analyses as the small sample size decreases the reliability of these tests. **Non-remediators** are students that were only enrolled in Anat A215 one time during the time frame of this study. It is possible that a student classified as a non-remediator did in fact remediate Anat A215. In such instances the students' first enrollment would have been prior to the spring 2004 semester, or their second enrollment was after the spring 2010 semester.

Materials & Methods

To determine if there are potential predictors associated with remediating students, demographic data from Anat A215 students from the spring 2004 semester through the spring 2010 semester were analyzed. Prior to collecting data, approval for this study was obtained from the Indiana University Institutional Review Board (study # 1004001288). The Anat A215 course directors provided the dissertation author with semester assessment data, including Anat A215 lecture exam scores, lab exam scores, total points earned and final letter grades. The IU Office of the Registrar provided additional demographic information which included students' age, ethnicity, school, major of study, ACT English, math, reading, science and composite scores, and SAT verbal, math and composite scores. Although ACT scores were provided, the overwhelming majority of students took the SAT. For those students who only completed the ACT, their scores were converted to comparable SAT scores (also

provided by Registrar). For the purposes, of analysis these derived SAT scores were included with all other SAT scores, and due to the small number of available ACT scores (subject and composite) were not included in analysis. IU Vault (IU now uses Slashtmp) was used in the data collection process as it allows for secure file sharing.

At the IU Bloomington campus there are several different schools, each of which is comprised of its own majors with specific admissions standards and degree requirements. Prior to being admitted to a specific school, most new undergraduate students begin their academic careers with the University Division (UD). Academic advisors in UD help students transition to life as an undergraduate student and aid students in the process of being admitted into degree granting programs within one of the schools which offer undergraduate degrees. Table 3.1 lists the specific schools at IU and a few examples of majors of study within each school. A complete list of majors within each school can be found at http://www.iub.edu/academic/majors/index.shtml.

Table 3.1
Indiana University School and Majors of Study

School Name	Sample of Majors
College of Arts and Sciences (COLL)	• Anthropology • Biology • English • History
School of Education (EDUC)	• Art Education • Elementary Education • Secondary Education
School of Health, Physical Education and Recreation (HPER)*	• Applied Health Science • Dietetics • Exercise Science
School of Informatics and Computing (INFO)	• Computer Science • Informatics
Jacobs School of Music (MUS)	• Ballet • Music Education • Voice
School of Journalism (JOUR)	• Journalism
Kelley School of Business (BUS)	• Accounting • Business • Legal Studies
School of Nursing (NURS)	• Nursing
School of Public and Environmental Affairs (SPEA)	• Arts Administration • Environmental Management • Public Affairs
School of Social Work (SWK)	• Labor Studies • Social Work

***Beginning in the 2012-2013 academic year, HPER was renamed as the School of Public Health.

Table 3.1 shows a small sample of the different majors of study available for students to pursue. In the initial analysis of this data there were 150 different majors of study. There were numerous majors in which there was only one student pursuing that specific field of study, and there were other majors in which there were over 1000 students. To better allow for comparisons, majors in similar fields were clustered together into one of 28 groupings. These 28 "majors" are listed in Table 3.2, along with the other demographic variables included in analysis.

Several statistical tests were utilized to provide an understanding of the characteristics of those students who remediate Anat A215 and to identify predictors for which students are at high risk for requiring remediation.

Comparisons were made between the following groups:

- All demographic characteristics within each semester of Anat A215 students
- Remediators and non-remediators
- Remediators enrolled in Anat A215 in the spring, summer and fall semesters
- Remediators who withdrew during first enrollment and remediators who earned a grade during first enrollment
- Remediators during the first time enrolled and the second time enrolled
- Short-term remediators (enrolled in Anat A215 the semester immediately following their first time in the course) and long-term remediators (enrolled in Anat A215 more than one semester after their first time in the course)

Statistical analyses were conducted with the statistical software package PASW Statistics 20, Release Version 20.0.0 (SPSS, Inc, 2011, Chicago, IL). The specific descriptive statistics that were analyzed and associated research questions can be found in Table 3.2. The results of this analysis were used to develop a general understanding of the entire Anat A215 student population and also specifically of remediating students. Independent t-tests, chi-square, ANOVA and logistic regression allowed for comparison of continuous and categorical variables to determine which variables may be significantly

different between remediating students and non-remediating students, and between the first and second times remediating students were enrolled in Anat A215. Preliminary results were presented at the Experimental Biology 2011 meeting in Washington, D.C. (Schutte, 2011).

Table 3.2
Remediation Variables

Variables	Breakdown per variable	Research Question
Sex	• Male • Female	Despite skewed female to male ratio in the class, is one gender more likely to remediate?
Age		Is there a relationship between the age of a student and the likelihood he/she will remediate?
Ethnicity	• Caucasian • African American • Asian • Hispanic • Other	Are students of a certain ethnicity more likely to remediate?
SAT Scores	• Verbal • Math • Composite	Are remediators' SAT scores significantly different than non-remediators?
Major of Study	• HPER: Non-ExSci/AthTrng/Diet/Nutr • Athletic Training • Dental Hygiene • Dietetics • Exercise Science • Biology • Exploratory Baccalaureate • Fitness Specialist BSK • General Studies • Chemistry/Biochemistry • Human Biology • Non-Degree SCS Ugrd • Nursing • Other Math/Science/Neuro/Info • Nutrition Science • Public Health • Music/Dance/Fine Arts • Psychology • Business/SPEA • Education • Pre-Allied Health • College:	Are students' of a particular major more likely to remediate?

	NonScience/Math • Other • Human Development/Family Studies • Nursing • Pre Radiation Therapy • Pre Radiography • SPHS	
School	• UDIV • College of Arts and Sciences • HPER • School of Education • Kelley School of Business • School of Informatics • Jacobs School of Music • School of Nursing • SPEA • School of Continuing Studies • School of Journalism	Are students of a particular school more likely to remediate?
Exam Scores	• Lab • Lecture (points earned were used in analysis instead of letter grades)	Are remediators' exam scores significantly different than non-remediators? Are remediators' exam scores during their first time in Anat A215 significantly different than the second time enrolled in the course?
Final Course Grade	• Total Points (this was converted into percentages, but letter grades were be used, as they vary slightly between semesters)	Are remediators' final grades different than non-remediators' final grades? Are remediators' first final grades significantly different than the second time in Anat A215?
Remediation Timeframe	• Short-term (students repeating Anat A215 1-2 semesters after their first enrollment in the course) • Long-Term (students repeating Anat A215 3-4 semesters after their first enrollment)	Is there a difference between short-term remediators and long-term remediators?

Results

Student Demographics

The general population of Anat A215 is primarily female (75.1%), Caucasian (86.3%) and affiliated with University Division (UD) (43%). Nearly one quarter (22.6%) of anatomy students are pursuing nursing as a major of study, followed by exercise science majors (19.7%). Table 3.3 provides an overview of the general population of Anat A215 student characteristics and more specifically, it shows a breakdown of the same variables amongst remediators and non-remediators. The complete demographic analysis, inclusive of all majors, schools, etc, can be found in Appendix A.

Table 3.3
Anatomy A215 Student Characteristics from Spring 2004 through Spring 2010

		A215 general population n=4622	Remediators n=511	Non-remediators n=4111
Demographic	**Characteristic**	%	%	%
Gender	Male	24.9	20.1	25.5
	Female	75.1	79.9	74.5
Ethnicity	Caucasian	86.3	81.3	86.9
	African-American	5.3	10.4	4.7
	Asian	4.1	4.7	4.0
	Hispanic	2.3	1.8	2.4
	Other	2.3	1.2	1.8
School	University Division (pre- allied health, pre-nursing)	43	59.1	41.0
	HPER (exercise science, athletic training, etc.)	29.3	29.4	29.2
	College of Arts & Sciences	23.5	9.8	25.2
Major	Exercise Science	19.7	21.1	19.5
	Biology	13.8	7.2	14.6
	Nursing	22.6	37.2	20.8

Chi-square analysis allows for comparison between categorical variables, and it was used to make comparisons among the variables included in Table 3.3 to determine if there are statistically significant differences between remediators and non-remediators. Nearly 80% of remediators are female, yet only 74.5% of non-remediators are female. Chi-square analysis was used to see if males or females are more likely to be remediators. The statistically significant Pearson chi-square value of 6.92 (p=.009) indicated that females are more likely to be remediators.

Chi-square analysis was also used to determine if students of specific ethnicities were more likely to be remediators. More specific evaluation of ethnicity and whether or not a student is a remediator revealed a statistically significant difference between Caucasian and Black/African American remediators and non-remediators (χ^2=29.03, p=.000). Significant differences were also found between Asian and Black/African American students (χ^2=5.627, p=.018). In both comparisons, Black/African American students were more likely to be remediators. No significant difference was found between Caucasian and Asian students. Additionally, when comparing Hispanic and White students, and Hispanic and Asian students, there were no significant differences. A statistically significant chi-square value (χ^2=8.699, p=.003) was found when comparing Hispanic and Black/African American students; this indicated that Black/African American students were more likely to be remediators.

Chi-square analysis was also used to determine whether or not students pursuing specific majors are more likely to be remediators. Comparisons between all majors generated a statistically significant chi-square result (χ^2=135.52, p<.000), which indicates there are specific majors which are more prone to remediate. As shown previously, in

Table 3.3, the most common majors of Anat A215 students are biology, exercise science and nursing. Comparisons between these three majors generated statistically significant differences between biology and exercise science majors (χ^2=16.32, p<.000), exercise science and nursing majors (χ^2=14.86, p<.000), as well as biology and nursing majors (χ^2=51.952, p<.000). These results show that exercise science majors are more likely to repeat Anat A215 than biology majors, and nursing majors are more likely to be remediators than either biology or exercise science students.

Chi-square analysis was also used to assess if students from a specific school were more likely to be remediators. Over 95 percent of Anat A215 students are affiliated with the College of Arts and Sciences, HPER or UD. Statistically significant chi-square values were generated in comparisons of each of these schools. UD students were more likely to be remediators than HPER (χ^2=11.578, p=.001) or College of Arts and Sciences students (χ^2=77.453, p=.000). Additionally, HPER students were more likely to be remediators than College of Arts and Sciences students (χ^2=35.544, p=.000).

SAT Mean Score Comparisons

Table 3.4 shows the mean SAT Verbal, Math and composite scores between non-remediators and remediators in Anat A215. Remediators had statistically significant lower scores in each specific section of the SAT, as well as statistically significant lower composite scores (p<.000 for each).

Table 3.4
SAT Comparisons between Anat A215 remediators and non-remediators

SAT Exam	Non-Remediator Mean scores	Remediator mean scores	t	p
Verbal	552.02	515.57	7.14	.000
Math	532.51	504.59	9.007	.000
Composite (Verbal + Math)	1097.81	1033.06	9.683	.000

To further assess differences between students, ANOVA was used to compare SAT math, verbal and composite scores of students of different genders, ethnicities, schools and majors. Table 3.5 shows the mean SAT verbal score, mean SAT math score and composite SAT scores for the demographic variables. Several statistically significant results resulted (p=.000 for all comparisons). Males had significantly higher SAT math and composite scores than females. Asian students had significantly higher SAT math, verbal and composite scores than White, Hispanic/Latino and Black/African American students. White students had significantly higher SAT math, verbal and composite scores than Hispanic/Latino and Black/African American students. Hispanic/Latino students had significantly higher scores than Black/African American students. Comparison of different majors revealed that biology majors had significantly higher scores than exercise science and nursing majors for SAT math, verbal and composite scores. Additionally, exercise science students had significantly higher composite SAT scores than nursing majors.

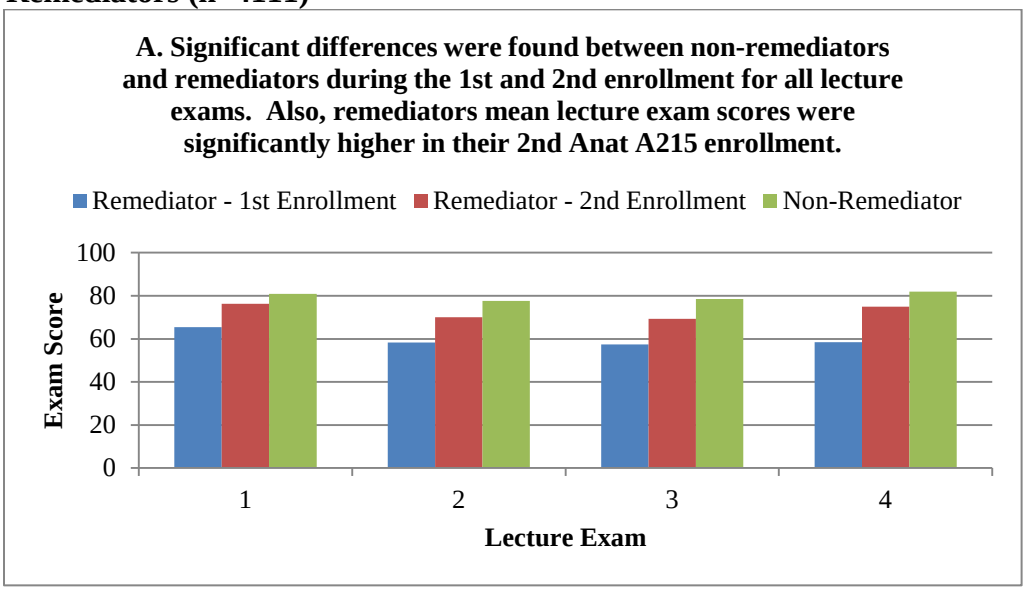
Table 3.5
SAT Scores by Demographic Variable

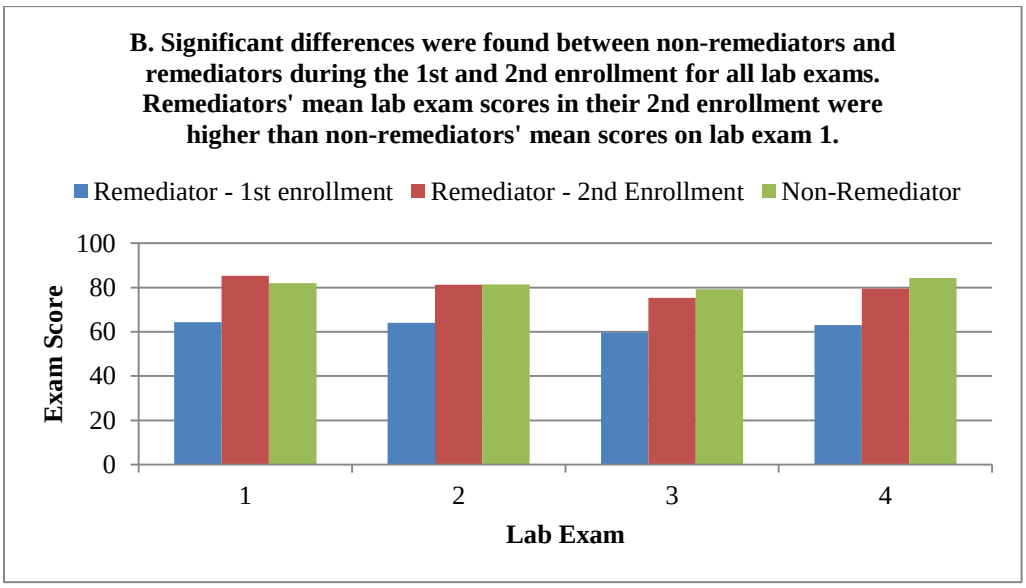
	Gender		Ethnicity				School			Majors		
	Males	Females	White	Black/ African American	Asian	Hispanic	COLL	HPER	UD	Biology	Nursing	Exercise Science
n	980	2994	3445	205	166	90	978	1100	1761	576	920	751
SAT Verbal	533.2	528.3	534.4	460.2	526.3	502.6	560.7	521.6	515.8	557	520.9	521.2
SAT Math	572.5	540.1	550.6	462.3	606.3	524	588	542.8	528.4	585.9	530.5	548.7
n	1074	3375	3858	235	179	100	1048	1299	1951	621	1026	879
SAT Composite	1113.7	1083.3	1099.1	930.2	1140.5	1032.6	1158.2	1080.1	1059.4	1149.8	1066.9	1088.6

Anat A215 Exam & Final Course Grades

Figure 3.1a shows the mean score (as a percentage) on each lecture exam for the first and second times a remediator took Anat A215 and the mean scores for non-remediators. Similarly, Figure 3.1b shows mean scores as a percentage on each laboratory exam for the same groups.

Figure 3.1
Mean Lecture and Lab Exam Scores for Remediators (n=511) and Non-Remediators (n=4111)





ANOVA was utilized to compare non-remediators and remediators' average exam scores earned during their first enrollment in Anat A215. The tests revealed statistically significant differences between these groups on every exam (p=.000), and the results of this analysis are shown in Table 3.6. Specifically, non-remediators had higher exam scores than remediating students. ANOVA also demonstrated a significant difference between remediators during their second Anat A215 enrollment and non-remediators for all lab exams and the first, third and fourth lecture exams (p=.000). Non-remediators still earned more points on all of these exams, except the first lab exam. Remediators during their second enrollment earned an average score of 85.34 points on the first lab exam, while non-remediators earned 81.98 points (p=.000).

Table 3.6
ANOVA Results: Remediators 1st Enrollment versus Non-Remediators Mean Exam Scores

Exam	Non-Remediators Mean Score	Remediators Mean Score	F	p
Lecture 1	80.87	65.37	501.06	.000
Lecture 2	77.56	58.34	529.43	.000
Lecture 3	78.49	57.47	506.32	.000
Lecture 4	81.94	58.46	617.78	.000
Lab 1	81.98	64.43	508.33	.000
Lab 2	81.35	64.00	497.91	.000
Lab 3	79.17	59.80	452.38	.000
Lab 4	84.34	63.00	575.47	.000

Paired t-tests were used to compare mean exam scores for each lecture and lab exam from remediators' first enrollment in Anat A215 to the corresponding exam scores during their second time enrolled in the course. For example, lecture exam 1 scores

during their first enrollment were compared to lecture exam 1 scores during their second enrollment. The results of the paired t-tests are shown in Table 3.7 and the differences between first and second enrollment were statistically significant for all exams (p=.000).

Table 3.7
Paired T-test Results: Remediators 1st Enrollment versus 2nd Enrollment Mean Exam Scores

Exam	1st Enrollment Mean Score	2nd Enrollment Mean Score	t	p
Lecture 1	65.37	76.35	16.73	.000
Lecture 2	58.34	70.33	13.11	.000
Lecture 3	57.47	71.18	12.97	.000
Lecture 4	58.46	76.60	13.82	.000
Lab 1	64.43	85.39	27.01	.000
Lab 2	64.00	82.02	23.07	.000
Lab 3	59.80	78.71	17.88	.000
Lab 4	63.00	82.17	14.88	.000

Additionally, mean exam scores were compared between various demographic variables using independent t-tests and ANOVA. Mean exam scores and total points for each gender, ethnicity, and major can be found in Table 3.8. When comparing gender, independent t-tests showed statistically significant results only for the first lab exam (t=2.347, p=.017), fourth lab exam (t=2.065, p=.039) and total course points (t=3.166, p=.002). Interestingly, in all three instances females had higher average scores. Previous chi-square results indicated that females were more likely to be remediators, so it would be expected that females would have, on average, lower exam scores.

Table 3.8
Mean Exam Scores by Demographic Variable

	Gender		Ethnicity				Major		
Exam	Male	Female	White	Asian	Black	Hispanic	Biology	Nursing	Exercise Science
lab 1	78.99	80.41	80.86	80.78	68.30	77.32	84.24	80.14	81.04
lecture 1	78.76	79.31	79.99	80.48	66.40	76.10	84.96	78.37	79.58
lab 2	78.80	79.74	80.16	79.34	68.31	79.12	82.62	79.94	80.23
lecture 2	75.83	75.44	76.29	77.18	63.06	71.71	80.86	75.02	76.41
lab 3	76.94	77.63	78.03	78.77	68.39	73.34	81.45	77.66	77.67
lecture 3	76.97	76.49	77.35	78.33	64.95	70.84	82.42	76.28	76.80
lab 4	81.55	82.83	83.09	82.87	72.53	81.31	85.93	82.36	82.48
lecture 4	79.97	79.94	80.64	82.11	67.10	75.65	85.48	78.19	80.74
total points	576.4	596.4	600.7	597.5	460.0	563.5	644.2	592.7	605.6

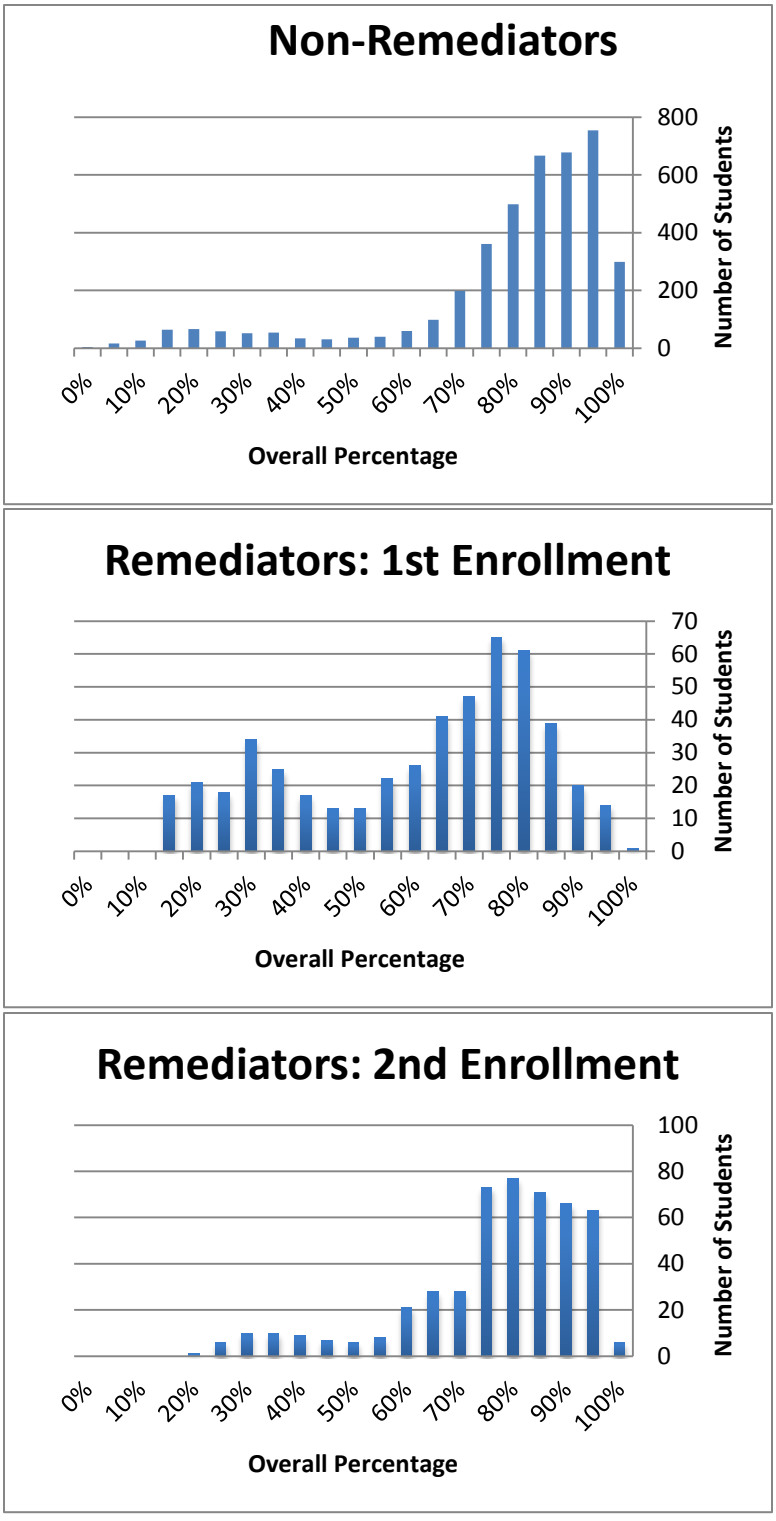
Comparisons between ethnicities generated statistically significant ANOVA results that line up well with previous comparisons between ethnicities. There were no statistically significant differences between mean exam scores of White or Asian students. There were statistically significant differences between all mean exam scores of Black/African American students and White, Asian and Hispanic/Latino students. In all comparisons, Black/African American students had lower mean exam scores (p=.000). These results are consistent with the chi-square analysis that showed Black/African American students were most likely to be remediators than students of other ethnicities. The other statistically significant differences that were observed were between White and Hispanic/Latino students on lecture exams 1, 3 and 4 (p=.000).

Differences between students of various majors were also found when comparing mean exam scores between the biology, nursing and exercise science majors. There were significant differences between biology and exercise science, as well as between biology

and nursing majors exam scores (p=.000). Biology majors had higher exam scores on all exams, which supports the finding that biology majors are less likely to remediate than nursing or exercise science majors. The only significant difference between exercise science and nursing majors was observed for the fourth lecture exam (p=.000) in which exercise science majors had a higher average score by 2.55 points. These results are also aligned with the previous chi-square results that demonstrated biology majors to be least likely to remediate and nursing majors being most likely to remediate.

Comparison of total course points earned revealed a skewed distribution among non-remediators and a bimodal distribution of remediators' grades during the first time enrolled in Anat A215. In Figure 3.2, the total course points have been converted into percentages. The maximum number of points a student can earn is 800 points. As shown in Figure 3.2, non-remediators' course grades are negatively skewed, with a peak between 85-100%. Remediators' course grades during their first enrollment in Anat A215 peak twice. One peak ranges from 30-35%, which would consist of students who failed the course. An even larger peak is seen around 75-80% during their first enrollment. The distribution of remediators' course grades during their second enrollment is much more similar to the distribution of non-remediators, as it is negatively skewed with a wide peak at 75%-95%.

Figure 3.2 Anat A215 Performance Scores Differ Between Non-remediators and Remediators' 1st & 2nd Enrollment



Logistic regression may be used for predicting the outcome of a categorical dependent variable; in this case the dependent variable is whether or not a student is a remediator. Ethnicity, gender, school, total course points, and SAT composite scores were included in this regression as predictor variables. All predictor variables were significant (p=.000) predictors of students remediating Anat A215. Upon closer examination of these findings, the regression supported the previous results that suggest Black/African American students, females, UD and students with lower total course points and SAT scores are more likely to remediate Anat A215.

Comparing Remediators

Recall that not all remediators completed Anat A215 during their first enrollment, and that a sizeable number of remediators withdrew. Of the 511 remediators in this study, 141 (27.5%) withdrew sometime after week 1 during their first enrollment in Anat A215. Table 3.9 displays the mean exam scores by remediating students during both their first and second times through Anat A215. These scores are further subdivided into students who withdrew during their first enrollment and students who earned a grade during their first enrollment. It is important to note that there is a withdrawal deadline during each semester. Prior to this deadline students may withdraw from a course regardless of whether he/she is passing the course. This deadline occurs after the second Anat A215 lecture exam but prior to the third exam. The vast majority of students who withdrew from the course had already done so prior to the third exams, leaving too few students from the group of withdrawn students for reliable statistical analysis. Although listed in Table 3.9, mean exam scores for the third and fourth lab and lecture exams for students who withdrew, are not included in the t-test analysis of the first Anat A215 enrollment.

Table 3.9
Remediators' Mean Exam Scores During 1st & 2nd Anat A215 Enrollment

Exam	Withdrew during 1st Enrollment in Anat A215	Scores for 1st Anat A215 Enrollment (%)	Scores for 2nd Anat A215 Enrollment (%)
Lab 1	Yes (n=141)	53.41*	80.61*
	No (n=362)	68.64*	87.27*
Lecture 1	Yes (n=142)	58.09*	73.08**
	No (n=362)	68.20*	77.62**
Lab 2	Yes (n=110)	51.53*	76.28*
	No (n=357)	67.84*	83.23*
Lecture 2	Yes (n=104)	46.98*	68.13
	No (n=360)	61.62*	70.82
Lab 3	Yes (n=350)	NA	66.16*
	No (n=15)	62.29	78.93*
Lecture 3	Yes (n=355)	NA	64.35*
	No (n=18)	59.80	71.29*
Lab 4	Yes (n=333)	NA	74.26*
	No (n=14)	65.65	81.61*
Lecture 4	Yes (n=333)	NA	71.70**
	No (n=14)	60.92	76.11**

*** Independent t-test significant at p<.000**
****Independent t-test significant at p<.01**

Independent t-tests were then conducted to compare each mean exam score of remediators who withdrew during their first Anat A215 enrollment to each mean exam score of students who earned a grade during their initial enrollment. For example, during the remediators' first Anat A215 course enrollment, the mean exam score for lab exam 1 was 53.41 for students who withdrew during their first enrollment, while the mean score on the same exam was 68.64 for students who did not withdraw. The independent t-test results were statistically significant (t=9.05, p=.000), showing that students who did not withdraw from the course earned significantly higher exam scores on lab exam 1. Remediators who completed Anat A215 during the first enrollment earned significantly

higher exam scores on both the first and second lab and lecture exams ($p<.000$). Additionally, these same students continued to earn significantly higher ($p<.01$) exam scores on most exams during their second Anat A215 enrollment. In Appendix B is a complete table of t-test results comparing mean exam scores in the first and second Anat A215 enrollment of students who earned a grade and students who withdrew during the first enrollment. Because of the large number of t-tests utilized in these comparisons and the increased type I error associated with numerous t-tests, ANOVA was conducted to repeat the previous comparisons between students who withdrew during the first enrollment and those who earned a final course grade. ANOVA results supported the t-test findings of significant differences on all exams, except the second lecture exam during the second Anat A215 enrollment.

To gain a deeper understanding of differences among remediators, those students who earned grades in their first attempt at anatomy were subdivided into high achieving students (students earning 584 course points or higher) and low achieving students (students earning 583.9 course points or lower). The mean exam scores and total course points for high and low achieving students are listed in Table 3.10. This table also includes results from independent t-tests which compared high achieving students to low achieving students. As one would expect, high achieving students had exam scores and mean total course points that were statistically significantly higher than low achieving students. Again, because of the increased likelihood of type I error occurring with numerous t-tests, ANOVA was conducted to double check these findings. ANOVA produced statistically significant differences ($p=.000$) between high and low achieving students on all exams in the first and second Anat A215 enrollments.

Table 3.10.
Comparing Mean Exam Scores of High and Low Achieving Students

Exam	High versus Low Achieving Students	n	Mean Exam Score (%)	t	p
1st Enrollment					
Lab 1	High	157	77.63	10.98	.000
	Low	205	61.76		
Lecture 1	High	157	75.46	10.48	.000
	Low	205	62.64		
Lab 2	High	157	76.81	12.02	.000
	Low	200	60.80		
Lecture 2	High	157	69.69	10.87	.000
	Low	203	55.38		
Lab 3	High	157	74.47	16.04	.000
	Low	193	52.38		
Lecture 3	High	157	70.02	13.47	.000
	Low	198	51.70		
Lab 4	High	157	79.47	15.89	.000
	Low	176	53.31		
Lecture 4	High	157	75.09	16.73	.000
	Low	176	48.27		
2nd Enrollment					
Lab 1	High	156	92.73	9.67	.000
	Low	201	83.04		
Lecture 1	High	155	84.72	9.72	.000
	Low	201	72.15		
Lab 2	High	154	90.72	11.13	.000
	Low	192	77.23		
Lecture 2	High	153	79.42	10.18	.000
	Low	191	63.92		
Lab 3	High	153	85.69	8.41	.000
	Low	179	73.15		
Lecture 3	High	153	80.44	10.39	.000
	Low	181	63.56		
Lab 4	High	152	88.13	8.17	.000
	Low	173	75.89		
Lecture 4	High	151	83.68	9.15	.000
	Low	174	69.55		

Additionally, paired t-tests were utilized to compare mean scores within the high achieving group and within the low achieving group. These tests demonstrated significant differences between individual exam scores and total course points for both groups during their first and second enrollments in Anat A215 (p=.000). It was observed

that the scores during the second enrollment exceeded those from the first enrollment for high and low achieving students.

A comparison of final course grades earned in the first and second enrollments showed that the vast majority of students increase their grades. Table 3.11 shows specifically that over 80% of students improved their course grade during the second enrollment, 13.68% earned the same grade, and 6.25% earned a lower grade in their second enrollment than in their first enrollment in Anat A215. Of the 150 students who withdrew during their first enrollment, 115 earned a passing grade in the course during their second enrollment. Even so, 18 of these students earned an F and 17 withdrew for a second time.

Table 3.11
Comparison of Remediators' Final Course Grades during 1st and 2nd Anat A215 Enrollment

	1st Anat A215 Enrollment					
2nd Anat A215 Enrollment	B	C	D	F	W	Total
A	30	44	6	4	15	99
B	8	50	38	13	36	145
C	2	17	40	34	39	132
D	0	1	11	20	25	57
F	0	2	2	15	18	37
W	2	3	3	14	17	40
Total	42	117	103	100	150	512

Short vs. Long Term Remediators

Also analyzed was the length of time between first and second enrollment in Anat A215. In this context "term" refers to a spring semester, fall semester, or a summer session. Throughout the course of one academic year, Anat A215 is offered during three

terms (spring, one summer session, fall). So for example, a 3 term enrollment difference would be observed if a student first enrolled in Anat A215 in the spring 2007 semester, and then enrolled a second time in the spring 2008 semester. A student was considered a "short-term remediator" if they repeated Anat A215 1-2 semesters after their initial enrollment in the course. Students were considered "long-term remediators" when the difference between their first and second Anat A215 enrollment was three terms or greater. Table 3.12 provides a frequency table for the term differences between Anat A215 enrollments. As previously discussed, the remediators in general are those students who were enrolled in Anat A215 at least twice during the study timeframe. This includes students who withdrew from the course after the first week of class during either their first or second enrollment.

Table 3.12
Frequency Distribution of Term Enrollment Differences Among Anat A215 Remediators

Term Enrollment Differences Between Enrollments	Number of students	Percent of total remediation population	Cumulative Percent
1	123	24.0	24.0
2	177	34.6	58.6
3	136	26.6	85.2
4	30	5.9	91.0
5	21	4.1	95.1
6	7	1.4	96.5
7	12	2.3	98.8
8-12	6	1.2	100

Most remediators enrolled in Anat A215 for the second time 2 to 3 terms after their first enrollment, 34.5 percent and 26.6 percent respectively. It was found that high achieving students averaged a 3 term difference, while low achieving students had an

average difference of 2 terms. Over 95 percent of remediators enrolled for the second time within 5 semesters of their first enrollment. Such a low number of subjects in these groups (5+ term enrollment difference) does not allow for reliable statistical analysis; therefore, the following statistical analyses were only conducted on students who remediated within 4 terms.

Independent t-tests were utilized to compare exam scores, total course points and SAT scores of students with 1-4 term enrollment differences. Appendix C includes two tables which show average exam scores and average total course points by students with 1, 2, 3 or 4 term enrollment differences. T-tests were run to compare mean exam scores during the first enrollment to the mean exam scores during the second enrollment for students based on their term enrollment difference. All scores included were deemed statistically significant ($p<.05$), indicating all students performed better during their second enrollment.

ANOVA was conducted to compare exam scores of students with 1, 2, 3 or 4 term enrollment differences. During the first Anat A215 enrollment there was no difference between students on the first lab or second lecture exam. Students with a 4 term enrollment difference outperformed students with only a 1 or 2 term enrollment difference on the remaining lab exams and the third and fourth lecture exams ($p=.000$). In the second enrollment students with a 4 term enrollment difference outperformed all others on the first and second lecture exams ($p=.000$). Students with a 4 term enrollment difference also outperformed students with a 1 or 2 term enrollment difference on lab exams 2, 3 and 4, as well as lecture exams 3 and 4 ($p=.000$) Overall those students who

waited 4 terms to repeat Anat A215 were more successful during their second enrollment than the students who remediated right away (1 to 2 term enrollment difference).

Discussion

Comparisons among student demographic variables demonstrated a number of trends associated with remediating students. Chi-square analysis indicated that females were more likely to remediate than males. The majority of Anat A215 students are female (75.1%) and approximately the same percentage of non-remediators are female. Yet, 79.9% of remediators are female. Although this result was significant, independent t-tests showed no difference between males and females on most exams. It is likely that the increased probability of females remediating Anat A215 is associated with the number of females who are pre-nursing majors. Collectively, nursing majors were more likely than any other major to remediate Anat A215. These students need to earn a high B or an A as a final course grade to be a competitive applicant to the nursing program at IU. Many of these students earn a grade that is well above passing during their initial enrollment in Anat A215, but it is not sufficient to be admitted into the highly competitive nursing program. These students then remediate the course with the goal of earning a higher grade. This trend explains the bimodal distribution of remediators' overall course percentages (specifically the large peak around 80%). This also helps explain why females are more likely to remediate despite there being virtually no difference between males and females mean exam scores.

Previous research has explored differences between genders and academic performance. One study observed statistically significant gender differences in course grades throughout the freshman year of college coursework but with no obvious cause

(D. Keller, Crouse, & Trusheim, 1993). Others found no significant gender bias when predicting course grades in introductory undergraduate courses with traditional predictors of success (aptitude tests, high school grades, etc.) (McCornack & McLeod, 1988). Females performing better than males on certain exams lines up with recent findings that female students were more likely to use effective study methods, better manage their time and were more motivated than their male counterparts (Marrs & Sigler, 2012). It seems that in this study gender is of minimal influence, if any, in regards to students remediating anatomy. Despite the greater percentage of female remediators than in the general Anat A215 population, females perform as well or better than males on exams and overall in the course.

Chi square analysis demonstrated that Black/African American students were more likely to remediate anatomy than students of other ethnicities. Black/African American students comprised a small percentage of the Anat A215 population (~5%), yet they make up approximately 10% of remediators. The data also show Caucasian and Asian students are outperforming Black/African American students on exams, as well as on the math and verbal sections of the SAT. Such trends have been observed in prior research. The relevance of SAT scores as predictors of academic success in undergraduate science majors, as well as factors such as high school grade point average, were consistent predictors of success across ethnicities, suggesting that these factors are more pertinent to academic success than differences between ethnicities (Astin & Astin, 1992; Smyth & McArdle, 2004). Smyth and McArdle (2004) examined data from 23 different colleges and found that standardized mathematics test scores or high school grades were positively correlated with success in science majors, regardless of gender or

ethnicity. While there were statistically significant differences between ethnicities in the current study, further investigation is necessary to determine the underlying cause of the observed differences.

Most students in Anat A215 take the course as a pre-requisite for admission into programs such as nursing. This pre-requisite status of anatomy has resulted in a large portion of Anat A215 students being a part of the University Division (UD). Most freshmen students enroll in UD, and they receive guidance from academic advisors about coursework as they decide the specific major they will pursue. In the general Anat A215 population, 43% were a part of UD, while 59% of remediators were from UD. Closer examination of students' majors of study revealed that nursing majors, who are also typically UD students planning to apply to nursing school, comprised 22.6% of the Anat A215 population and 37.2% of remediators. Anatomy seems to be particularly challenging for UD students. These students are in the early part of their undergraduate careers, and therefore may not be prepared for the rigor of Anat A215. Even so, not all remediating students performed poorly in Anat A215 during their first enrollment. As previously mentioned, some students earn a passing grade, but it is not sufficient for them to be a competitive applicant to programs such as nursing. When exam scores were compared between majors, nursing students performed just as well as exercise science students. Biology majors, who are a part of the College of Arts and Sciences, performed better than exercise science and nursing students. It is possible that having selected a major or being admitted into a specific program has increased the students' level of commitment to academic success, which seems reasonable as it has been shown that there is a positive correlation between students with greater concern with learning and

performance goals and high academic achievement (Barron & Harackiewicz, 2001; Bouffard, Boisvert, Vezeau, & Larouche, 1995). Differences between students in biology and other majors could also be explained by these students being more advanced in their coursework and better able to handle challenging courses.

Additional comparisons revealed remediators had significantly lower verbal, math and composite SAT scores than non-remediators. It is possible that students who retake Anat A215 suffer more from text anxiety or are generally poor test takers. This could help to explain the significant differences observed between remediators and non-remediators on Anat A215 lecture and lab exams and total points. The use of the SAT as a predictor of academic success has been extensively researched, and many have found the SAT to be a good predictor of undergraduate academic success, especially when combined with high school GPA as a predictor of success (Bridgeman & Wendler, 1989; Burton & Ramist, 2001; Camara & Echternacht, 2000). Similarly, Kobrin and Michel (2006) examined SAT scores, high school GPA and freshmen year college GPA of roughly 34,000 college students and found that the SAT was at least as good as high school GPA in predicting college success (at least in the first year of college). Even so, their results also showed the SAT was not able to predict the highest performing students (Kobrin & Michel, 2006).

When comparing distribution of mean exam scores of non-remediators and remediators several trends were observed. The non-remediators' negatively skewed distribution is not surprising, as it is expected that students who don't repeat anatomy would have performed better initially. The peaks in the bimodal distribution of remediators overall percentage in the course likely represents students who performed

fairly well in the course, but wanted/needed to boost their scores for program admissions, and those students who failed the course.

It was also not surprising to find that on average, remediators scored significantly lower on all exams than non-remediators during their first enrollment. The negatively skewed distribution of remediators' exam scores during their second enrollment also seems logical, as it would be expected that the students would perform better the second time enrolled. Remediators performed significantly better on all exams during their second enrollment in Anat A215. On the first two lab exams the remediating students even had a mean score that is greater than the non-remediating students mean scores. Remediating students were familiar with the exam procedures, and most of these students had experience with the course content and large volume of material being covered on these exams. This likely gave them an advantage on the first and second exams. Even with such an "advantage," this trend was only in lab. Non-remediating students perform better on all lecture exams than remediating students in their second Anat A215 enrollment. Lab exams are often perceived by students to be easier than the lecture exams, which is understandable, as the types of questions asked in lab exams are lower level questions on Bloom's taxonomy. Blooms taxonomy is a model which classifies thinking according to different levels of complexity (Forehand, 2010; Krathwohl, 2002). The lowest level is that in which one "remembers" (Airasian et al., 2001). In an exam a question testing students at this level would simply expect students to recall information. Higher level questions become more complex and require students to understand information on a deeper level, apply that knowledge and potentially analyze and evaluate information (Airasian et al., 2001; Forehand, 2010). Anat A215 lecture exams include a

mixture of questions that require thought at many levels of Bloom's taxonomy, which is likely why students perceive these exams to be more challenging.

Several noteworthy differences within the group of remediating students were found upon examination of the data. Remediators who earned a grade during their first enrollment in Anat A215 (therefore completed the course) subsequently performed better on exams during their second enrollment than did students who withdrew during either their first or second enrollment. Students who earned a grade were at least exposed to all of the material throughout the first enrollment, and it seems likely that some familiarity (even if minimal) with the information being presented may have made it easier to understand and learn when exposed to it again. If students withdrew from the course they did not partake in at least half of the semester, and lacked exposure to the material the other students gained. When students who earned a grade during their first enrollment are divided into two groups, the high achieving students outperformed the low achieving students during their second Anat A215 enrollment. Even so, both groups improved their grades significantly during their second enrollment. As shown in Table 3.11, over 80 percent of remediating students improved their Anat A215 during their second enrollment. Overall, students are improving their performance during their second Anat A215 enrollment, regardless of whether or not they withdrew during the first enrollment. Even so, it seems the best advice for a student considering withdrawing from the course would be to remain in the course and continue to study even if they will need to repeat the course during a later semester (if feasible for scheduling and finances).

Just over 85% of remediating students remediated within 4 semesters of their first enrollment in Anat A215. Students remediating Anat A215 the semester

immediately following their first time in the course (1 term enrollment difference) outperformed students who remediated 2 terms later. Students with 1 term enrollment difference may have better recall of material covered in the course, as their exposure to it is more recent than students remediating 2 terms later. Interestingly, students remediating 3 or 4 terms later outperformed the students remediating only 1 or 2 terms after their first enrollment.

Regardless of the length of term A215 enrollment difference, students' exam scores and therefore, course grades, improved significantly. It seems, though, that it would be most beneficial for students to wait to re-take anatomy until 3 or 4 terms after their first time through the course. It may be that students are able to develop their study habits and test taking skills during this time, resulting in them being better able to handle the volume and difficulty of the material presented in Anat A215.

Anatomy is a challenging course, even for students in the later years of college, so perhaps it is important for instructors to keep a watchful eye on the younger UD students at IU. The observed results suggest that freshmen and sophomore students at other 4-year institutions are at greater risk of struggling in courses like anatomy (backed up by other research). Even if a student will need to repeat the course, remaining in the class for the entire semester seems to result in greater success the second time around. Students who need to remediate Anat A215 may benefit more from waiting to re-enroll until three or four semesters after their initial enrollment. It's also important for academic advisors to consider these findings, particularly when helping incoming freshmen set up their schedules. It may be more beneficial for students to complete other coursework and develop their study skills before taking on the challenge of anatomy.

Chapter 4: Development of a Study Skills Course

As Associate Instructors (AI) in the Anat A215 labs, an MS student in Anatomy (she will be referred to as J. Smith) and I noticed several trends amongst our students which were disconcerting. Each semester we encountered at least a student or two in each of our laboratory sections who had previously taken Anat A215. Many students, regardless of the number of times they had taken the class, seemed to struggle with how to begin to approach the material being presented in lab. It was also not unusual to hear students complain that they studied for hours, or that they thought they were adequately prepared for the exam, yet they did not earn the grade they expected. Many students experienced a disconnect between their study habits and the grades they earned on exams. They sometimes recognized that they needed to change how they prepared for exams, but didn't know what changes would be most effective. Discussions during the weekly anatomy graduate student seminar led to the idea that an undergraduate course about study skills taught in the context of anatomy might be beneficial for Anat A215 students. The course would be geared toward students who were remediating Anat A215, as well as those who recognized they may need assistance.

There were already general study skills courses and other resources available to IU students. A supplemental instruction program is run by the Student Academic Center (SAC), in which peer-led group study sessions are held for challenging courses (mostly math courses) (http://sac.indiana.edu/supplementalInstruction). Students learn and discuss study strategies they may employ to be successful in the various math and economics courses. The SAC also offers a variety of other resources to assist students with their study skills, including a 2-credit hour course which aims to help students

manage college life (http://sac.indiana.edu/xOneFiveSixLifelong). Past Anat A215 students have been encouraged to take advantage of these resources so that they can better handle the challenges in Anat A215. Even so, anatomy is unfamiliar to many students and presents challenges that stump even the brightest students. General study skills are beneficial, but a course specific to anatomy would allow for more detailed attention to be placed on the challenges unique to anatomy and other difficult science courses.

As this idea was discussed more thoroughly, J. Smith and I began working together to develop this undergraduate course with the goals of helping anatomy students to improve their metacognitive skills so that they could better monitor their learning process, as well as teach them study methods in the context of anatomy. Our advisor and chair of the Medical Sciences Undergraduate Committee, Dr. Valerie O'Loughlin, supported this project and encouraged the development of this new Medical Sciences course.

Backwards Course Design: Creating MSCI M100

The development of this new course involved several steps, all of which were a part of an ongoing iterative process. We followed a backwards course design approach in developing MSCI M100: Improving Learning Skills in Anatomy (MSCI M100). Such an approach does not begin with a focus on the textbooks and activities to be used in class; instead, using a "backward design" approach, course developers begin by clearly establishing the learning goals of the course (Wiggins & McTighe, 2004). After the goals are outlined, how the students and instructor will know if the goals have been met is considered. This is followed by designing activities centered around achieving the

desired goals/results (Fink, 2003). Designing a course in this fashion is meant to help students understand the relevance of what they are learning and increase meaningfulness of said activities (Daugherty, 2006; Wiggins & McTighe, 2004).

As we began the development process, one of the major goals for MSCI M100 students was to improve upon their ability to recognize and implement study methods that best fit a particular situation. This would require students to be able to analyze the effectiveness of their study methods. Another goal for MSCI M100 was for students to be able to explain and differentiate most major body systems. While reviewing Anat A215 course material would not be the primary focus of MSCI M100, one way for a student to determine if a particular study method is working is to easily explain what they're learning in Anat A215. The plan for in-class activities revolved heavily around teaching students study methods in the context of what was being taught concurrently in Anat A215, as such an approach has been shown to be effective for promoting learning (Anderson, Reder, & Simon, 1996; Blumberg, Mostrom, Bendl, Kimchuk, & Wolbach, 2005). This approach would give students the opportunity to practice new methods, while reviewing information from anatomy. The hope was that students taking MSCI M100 would then do well in Anat A215. This last course goal was for students to apply their knowledge to clinical situations. This goal was included because the vast majority of Anat A215 students plan to enter a health-related field, therefore most MSCI M100 students would also be pursuing health careers. Although this is not a major focus of Anat A215, clinical scenarios would provide opportunities to integrate material and add interest for the students. It was important to the MSCI M100 developers that students be able to think critically about and apply their anatomical knowledge.

MSCI M100 Course Assignments

After establishing learning goals for the course, the next step was to begin selecting assessments which would help students to achieve the course goals. There were certain behaviors and/or skills which were key to achieving those course goals. These behaviors and skills were defined as core competencies for the course. Table 4.1 summarizes MSCI M100 course goals, core competencies within each goal and the specific assessments which would be used to attain each goal.

Table 4.1
MSCI M100 Learning Goals, Core Competencies and Assessments

Learning goal	Core Competencies	Assessment
• Recognize different ways you learn effectively and introduce these into your studies for Anat A215	• Effectively analyze your exam performance • Utilize multiple study methods • Evaluate which study methods are best for you	• Journal writings • Survey about study habits • A215 Laboratory exam analysis
• Explain and differentiate most major body systems	• Compare and contrast the functions of each body system • Describe how these major body systems interact with one another	• Pre-lecture quizzes, histology quizzes
• Implement anatomical knowledge in clinical situations	• Connecting various symptoms and pathologies to the body systems affected	• Problem based learning exercises • Pre-lecture Quizzes

Journal writings were completed on Oncourse, IU's course management system, by students prior to each class meeting. The topic for each entry was provided by the instructors and they were expected to be submitted prior to class so the instructors could

review responses. The *journal writings* were one of the primary assignments in which students would be reflecting and evaluating their learning process. These writings also served as a way for instructors to assess changes in students' metacognition. *Journal writings* were chosen as a regular assignment because reflective journals have been previously cited as an effective tool for undergraduate students to practice skills, including improving their metacognition (Belzer et al., 2003; Fonteyn & Cahill, 1998; Thorpe, 2004).

An activity that was completed prior to each Anat A215 exam was *problem-based learning (PBL) exercises*. *PBL exercises* are simply problems or scenarios that are written by an instructor, posing questions to students about a particular phenomenon or patient problem (Barrows, 1986; Walton & Matthews, 1989). These exercises were incorporated in MSCI M100 to help students integrate material, while adding interest through "real-life" scenarios. Multiple structures and body systems can be affected by one injury or illness, and each *PBL* led to discussion about structure and function of those body systems included in a given *PBL*. Part of one class period prior to each Anat A215 lecture exam, students worked in small groups on each *PBL*, in which they were provided a patient with a health issue(s) and several questions about those issues. The class period would end with the entire class discussing the case. The patient problems always related to the body systems being covered in Anat A215, and a sample PBL can be found in Appendix G.

Rehearsal is often used as a memory strategy (Siegler et al., 2005), yet many students do not seem to recognize the variety of methods that would involve rehearsing information without simply rereading or rewriting the same notes or text repeatedly. As a

result, *pre-lecture quizzes* were implemented in MSCI M100 as an opportunity for students to gain repeated exposure to the material in Anat A215, as well as practice with the type of questions they'd encounter on anatomy lecture exams. These *pre-lecture quizzes* consisted of 5 questions based on the assigned Anat A215 lecture readings, and they were to be completed online prior to class to allow for discussion in MSCI M100 if needed. The questions were typically multiple choice questions, as these provided students with practice answering questions in the format of their exams. Occasionally students were asked to answer short answer or matching questions.

MSCI M100 students were also expected to evaluate their exams, assessing which questions they missed, how much effort was put into studying and how well their grade matched their expectations based on their preparation. The students discussed changes they could make to their study habits prior to the next lab exam. These exam evaluations were completed in the *journal writings* (via Oncourse). There are four lecture and four laboratory exams in Anat A215, and the students completed these evaluations for the first three sets of exams. The fourth lab and lecture exams are given during the last week of the semester, therefore there was not an opportunity to follow-up with these exams. Particularly after the first exam, there was also discussion in class about how students could better prepare for the upcoming exam. Students shared study tips with each other, and discussed what worked well for them.

In addition to the assessments already discussed, there were several other in-class exercises which would give students practice with an array of study methods. Such exercises were generally categorized as *study exercises*. In the summer 2010 session this included creating histology slides, completing study logs prior to each exam, and practice

using various study methods. The histology slides and study logs will be discussed in greater detail later in this chapter. During class meetings students were able to practice using many new study methods, such as creating a concept map or memory matrix. The instructors would describe and model how to effectively use a particular method, and students would then be given an opportunity in class to work in a group on a second example. For example, a memory matrix is essentially a chart that had headings already provided for students that can be used to test one's memory, as well as help organize course material (Angelo & Cross, 1993). Students could then take time in class to fill out the matrix and then the class, as a whole, can regroup to discuss the correct answers. In class the instructors would not only provide students with matrixes, but they would ask students to create their own matrix.

Lastly a final project was planned for the end of the semester which would require students to integrate their knowledge of several body systems and understanding of how those systems work together. This project was designed to be a large PBL exercise, integrating multiple body systems, in which the students would work together outside of class. It was assigned 2 weeks prior to the end of the semester, and the students' answers to all of the questions presented in the PBL were due by the last day of class. The PBL could then be discussed in class, addressing any issues they students had comprehending material. This also provided the students with review for the last anatomy test, as the final MSCI M100 class meeting was prior to the final Anat A215 lecture exam. A complete description of the initial offering of the course may be found in the syllabus from the 2010 summer II session, which is in Appendix D.

Approval Process for MSCI M100

Once MSCI M100 was initially developed and a syllabus was prepared, approval to offer the course had to be obtained from the Medical Sciences Undergraduate Education Committee. The proposal to the committee included the course description, which can be found on the syllabus in Appendix F, as well as the course developers' qualifications to teach the course and predicted outcomes for the course. The proposal stated MSCI M100 would be offered to students concurrently enrolled in Anat A215 beginning in the 2010 summer II session. During a fall or spring semester, MSCI M100 would meet hourly once per week, but as the summer II session was approximately half the length of the fall and spring semesters, MSCI M100 would meet twice weekly. Anatomy graduate students (Audra Schutte and J. Smith) would instruct the course, and the plan was for MSCI M100 to become a regular course offering. The complete course proposal that was submitted to the Undergraduate Education Committee can be found in Appendix H. Course activities and assessments were discussed, as well as anticipated student outcomes from participating in the course. The committee granted approval for the course, and 5 students enrolled in the pilot session of MSCI M100 during the 2010 summer II session. MSCI M100 was positively received and so it was offered again in the Spring 2011, Summer 2011, Fall 2011 and Spring 2012 semesters. The course was not offered in the Fall 2010 to allow the instructors/course developers sufficient time to assess the success of the course's initial offering. The author (Audra Schutte) was an instructor for M100 for these semesters, and in later semesters MSCI M100 is being taught by other graduate students in the Medical Sciences Program.

Evolution of MSCI M100

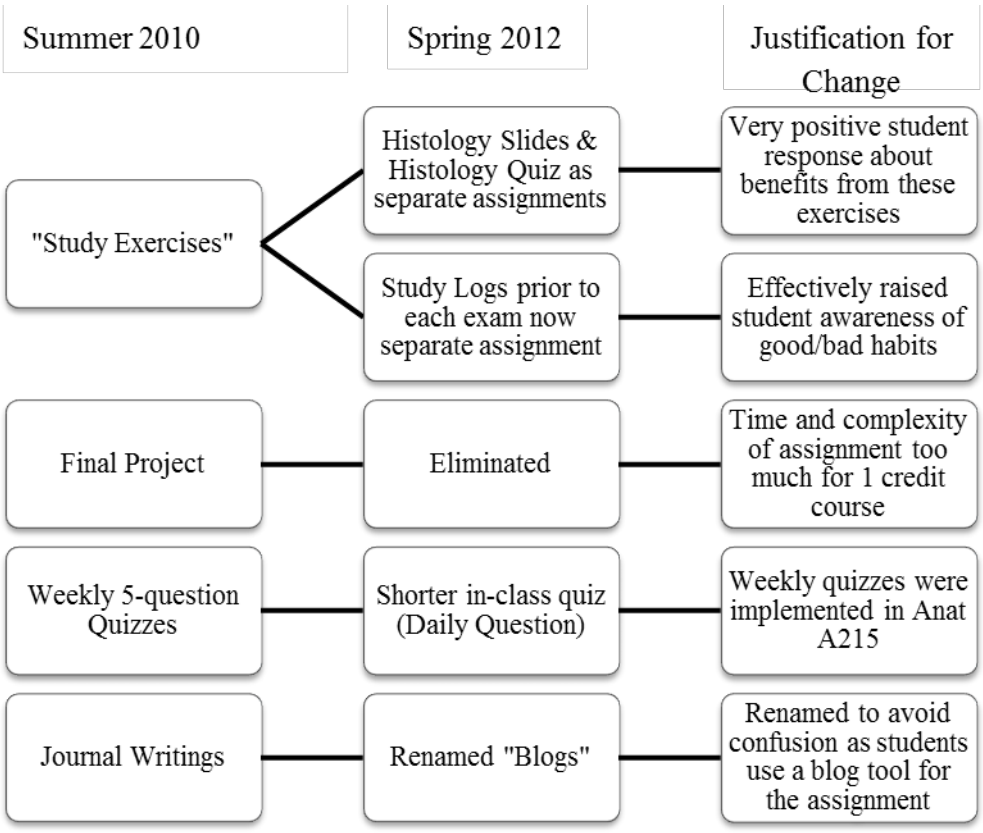
Developing and teaching MSCI M100 has been an iterative process. The 2010 summer II session was the first time MSCI M100 was offered and taught. There were 5 students enrolled, all of whom remained in the course for the entire summer. Four of the five students were engaged throughout the summer and provided valuable feedback about activities and assignments in the class that worked well and those that did not. The instructors spent time evaluating the summer offering of MSCI M100 for activities that went well, what issues arose for the students, as well as how instruction could be improved (Keller & Schutte, 2011). Small adjustments have been made after each semester the course has been taught with the hopes of improving students' experiences and success in Anat A215. Some changes also were made to accommodate the increase in enrollment and decrease in the number of instructors. Enrollment increased from 5 students (during the 2010 summer II session) to 41 students (during the spring 2012 semester). Table 4.2 provides the details of course enrollment and instructors by semester from the pilot of the course through the 2012 spring semester.

Table 4.2
MSCI M100 Course Enrollment by Semester: Summer 2010-Spring 2012

Semester	Instructor(s)	Course Enrollment
Summer 2010	Schutte & Smith	5
Spring 2011	Schutte & Smith	29
Fall 2011	Schutte	40
Spring 2012	Schutte	41

As enrollment increased and the instructors gained experience teaching the course, a variety of modifications were made to the course and assignments for the students. These changes can be seen in the course syllabi from the pilot and the most recent course offering. Appendix D contains the syllabus for the initial offering of MSCI M100 in the 2010 summer II session, while Appendix E has the syllabus for the spring 2012 semester for comparison. Figure 4.1 summarizes the course assessment modifications as instructor and student numbers changed, and the following discussion elaborates upon these modifications.

Figure 4.1
Modifications to MSCI M100 Course Assessments



As mentioned previously, s*tudy exercises* were inclusive of small in- and out-of-class assignments students would complete throughout the course. One of the in-class study exercises was creation of digital histology slides. Students would take a screen capture from the Anat A215 virtual microscope (http://www.indiana.edu/~anat215/virtualscope2/start.htm), and then the students labeled the image in Microsoft PowerPoint. Since 2010 summer II session had only 5 students, it was simple for the entire class (students being led by instructors) to work in a computer lab at the same time. If time permitted, students would each write a question or two on each slide and then rotate through the computers and answer each other's questions. The feedback from this activity was so positive that creating histology quiz questions became its own assignment in the course for future semesters, and the instructors used slides

submitted by students to generate a quiz for the entire class. When MSCI M100 enrollment increased, this activity was modified whereby students were required to submit the slides to Oncourse prior to class and then the histology quizzes were given in class.

Study logs were adapted from Angelo and Cross (1993), as were another of the many "study exercises" included during the first semester of MSCI M100. Students recorded where and when they studied for three days prior to the Anat A215 lab and lecture exams, and they rated their productivity during those times. Figure 4.2 provides a sample study log completed by a student. To rate their productivity students used a 4-point scale in which 1 equaled non-productivity, and 4 equaled high productivity. In class the ratings were further discussed to clarify what was meant by each rating. For example, it was discussed that if a student is spending a significant amount of time on the Internet (watching videos, checking email or Facebook, etc.) or generally being distracted by those around them that their productivity rating would likely be a 1 or 2. The appropriateness of a 1 or 2 would be dependent upon how much learning was accomplished. If the student learned nothing then it was expected that a 1 was assigned to that section of time. While there was initially concern about the subjectivity in assigning productivity ratings, the students did not express any difficulties with distinguishing one rating from another. Additionally, when instructors reviewed the submitted study logs there did not appear to be confusion about how to rate one's study time.

Figure 4.2
Sample Study Log

Directions: (1) Enter any block of thirty minutes or more you spent studying anatomy today on the form below. If you started at 2 P.M. and ended at 2:40, use the lines next to 2:00 only. (2) Make a note of where you were studying. (3) Make sure to rate the productivity of each half-hour segment in the appropriate column, using the following scale

1 = Nonproductive	Learning nothing or extremely little
2 = Low productivity	Learning something but not much
3 = Average Productivity	Learning a fair amount
4 = High Productivity	Learning a great deal

Productivity Ratings	Time	Place	Productivity Ratings	Time	Place
	8:00 A.M		4	5:30 P.M.	
	8:30		4	6:00	
	9:00		4	6:30	
	9:30			7:00	LAB EXAM
	10:00			7:30	
	10:30	DR.		8:00	
2	11:00	appointment		8:30	
2	11:30		2	9:00	Home
4	12:00 P.M	campus	3	9:30	"
4	12:30	Jordan library	2	10:00	Home
4	1:00		4	10:30	
4	1:30		4	11:00	
	2:00	math class	4	11:30	
	2:30			12:00 A.M.	
	3:00			1:00	
4	3:30	Jordan library		1:30	
4	4:00			2:00	
4	4:30			2:30	
4	5:00			3:00	

Subtotal A: Hours of anatomy study rated at Level 1 = 0
Subtotal B: Hours of anatomy study rated at Level 2 = 2
Subtotal C: Hours of anatomy study rated at Level 3 = .5
Subtotal D: Hours of statistics study rated at Level 4 = 7
Total hours spent studying anatomy today = 9.5

Students in the 2010 summer II session had a range of reactions to their study logs when reviewing them. Most students expressed some degree of surprise about how low their productivity was at a certain time of day or in a specific location. Class discussion involved the types of distractions students noticed and how they might combat those distractions in the future. As the summer class progressed, the students commented that even just the knowledge that they would need to fill out the logs helped them focus better, in addition to being more selective about when and where they studied. The study logs, especially the first time they were completed, seemed to be very useful in helping

students recognize good and bad habits in their studying. A thorough analysis of the study logs can be found in chapter 5. Like the histology slides, study logs were made a regular MSCI M100 assignment in future semesters.

During the first semesters MSCI M100 was taught (summer 2010, spring 2011, fall 2011) students were asked to review their logs as one of their journal entries. They were to discuss patterns they noticed, good/bad habits that were brought to their attention and anything else that surprised them. In the spring 2012 semester, this reflection of the logs was included as a regular part of the study logs assignment so that the journal entries could be used to discuss additional topics.

The *final project*, which we hoped would help students make connections about how the various body systems work with each other, was eliminated from the syllabus after the first two terms of teaching the course. Instead of using it as a learning tool to develop their understanding of the body, students seemed to rush through it, overlooking the main points of the assignment. They also complained that the final project was too much work for the class. As MSCI M100 only meets once per week and is only worth 1 credit hour, it was decided that students may benefit more from activities other than the final project. Other in-class activities and smaller assignments would still be utilized to help students make connections between body systems.

One of the original assessments that was adjusted were the *pre-lecture quizzes*. Weekly quizzes were implemented in Anat A215, and so weekly quizzes of the same nature in MSCI M100 were considered to be redundant. Still, it was important students be held accountable for the material being covered in anatomy each week; therefore a *weekly two-point quiz* (given at the beginning of class) and *weekly outlines* were

implemented. For the *weekly outlines* students were expected to go through lecture material presented that week in Anat A215 and organize it in a manner which made sense to them. This may have been creating charts or diagrams, flash cards or literally creating their own outline of the material. These *weekly outlines* were meant to help students stay current with their studying and not "cram" for their exams. The *weekly two-point quiz* also served as a means of accountability. Students were typically presented with a single multiple choice question (worth 2 points) at the beginning of each class meeting. These questions followed the same question format used in Anat A215 lecture exams. After students turned in their answers to the question, the entire class would discuss the question and the viability of each answer option. These questions were an opportunity to review Anat A215 course material, as well as practice test-taking methods for the exam.

In Appendix E you will find the most current syllabus of MSCI M100, which provides details about the assignments as they were conducted in the Spring 2012 semester. One small change in the most current syllabus is the title given to the *journal writings* assignment. Students completed these entries through the use of a "blog" tool that is available via Oncourse, IU's course management system. In order to avoid confusion, the name "*journal writings*" was changed to *blogs*, and such terminology will be used for the remainder of this discussion. The blogs have continued to serve as a valuable tool for students to reflect on their learning process, as well as a way for the instructor to assess changes in student metacognition.

The evolution of MSCI M100 has continued each time it has been taught. It was designed to become a regular course offering from Medical Sciences, even after the course developers were no longer available to teach it. Other anatomy education

graduate students have the opportunity to teach the course. The course goals and many of the assignments and activities remain the same, but each graduate student who teaches the course has a slightly different approach to reaching those goals.

2010 summer II session: A Pilot Study

The five students who enrolled for the first offering (2010 Summer II session) of MSCI M100 provided valuable feedback about the course in general, as well as specific activities and assignments that were completed in class. In particular, four of the five students were very open and shared their opinions both verbally and in writing via their blogs. Three of these four students seemed motivated and engaged throughout the summer, and were all quite thorough in their responses. The fourth student, although obviously less motivated, was also very honest about her motivation, and she was still able to provide useful feedback. The fifth student in the course seemed to struggle in both Anat A215 and MSCI M100, and although frustrating at times, this student provided insight into potential challenges to be encountered in future semesters. The following discussion will revolve primarily around the experiences of the 2010 summer II session of MSCI M100, as it was these experiences that shaped much of how the course was taught in subsequent semesters. Analysis, results and discussion of the later semesters of the course will be thoroughly discussed in Chapter 5 of this dissertation.

MSCI M100: 2010 Summer II Session Positive Results

Improving students' metacognitive skills, their awareness and monitoring of their learning process and how to effectively adjust it in specific situations, was a primary goal of this course. Students were not asked to directly study metacognition, but it was indirectly addressed through the use of the blogs, as well as certain study exercises like

the study logs. Throughout the 2012 summer session students were asked in their blogs to evaluate their study habits and what could change so that they might see improvements in their Anat A215 exam performance. As the summer progressed, both blog responses and in-class discussions shifted from more surface level approaches to learning, to a desire for a deeper understanding of the material. Initially, students discussed memorization as a primary method for studying, and it seemed difficult for many of them to grasp how one might go about learning anatomy without memorization as the primary study method. As the summer progressed, students began discussing (without prompting by instructors) how lecture material connected with lab material, and they began using study methods which promoted learning beyond memorization. During the second half of the semester, three out of five students commented in their blogs that there were trying to connect lab and lecture material, as well as attempting to connect the new material they were learning to previously learned material. Students became more cognizant of their study habits and actively suggest changes to their study habits. After the second set of anatomy exams, one student said in her blog:

> "I want to use the online tools for lecture more effectively. Last time I filled out the matrixes but I only did it the night before the test and then reviewed that material. This time I want to fill them out earlier and many different times until I can complete them without using my notes."

After the third set of anatomy exams, another student discussed at length how her grade was in the range she expected, and although she would have like it to be higher, she made some great progress toward correcting a bad habit that she's had for a long time. These students recognized something that could work better for them if they made the appropriate adjustments, and at the very minimum, they proposed a change. One student certainly made changes to strive for improvements, and was pleased to have done so

successfully. At the very end of the summer, the students were asked to discuss what they've taken away from the course and one student stated, "[MSCI M100] truly taught me how to study, but also how to recognize when a study technique doesn't work well for me." This student clearly reached the goal of improved metacognitive awareness.

Relating anatomy to 'real-life' clinical situations seemed to spark interest and motivation in anatomy. Two students described problem based learning exercises (PBLs) as one of their favorite class activities because of how it helped them relate class material to "real life." Three students mentioned in their blogs that the PBLs were a helpful learning tool. Although the PBLs, in class discussions and many of the quiz questions drew from clinical situations, one of the students felt there could be even more exercises like these in future semesters. One student mentioned, "I'd also maybe try to find more ways to relate what we're learning in class to 'real life'...so whether that's problem based exercises, or else having the students think of real life relevancy, I think it helps a lot."

Although the target audience for this MSCI M100 was students who are in the early stages of their college career and need to develop their study skills and/or students who are repeating Anat A215, it is a course that could be helpful to students at any stage of their college career. One of the 2010 summer II session students was a senior about to enter graduate school. Despite having successfully completed almost the entirety of her coursework, she commented in one of her blogs, "I really am glad I took this course because it forced me to study and it taught me a lot about how I learn. Most of the study techniques you suggested in class I never would have thought on my own." Similar comments were made by all of the other students. Three of the five students commented in their blogs that the course helped them stay current with Anat A215 material, it was

helpful to have someone other than the lecturer explain material, and that they appreciated being "forced" to try new methods that they had either never thought of or would not have normally tried on their own. Lastly, all five students discussed in their blogs that what they learned in MSCI M100 would benefit them in their future coursework.

MSCI M100: 2010 Summer II Session Challenges

It was clear that some of the students benefited from the course and saw its value in helping them improve their individual learning strategies. Not surprisingly, the students who put less effort into MSCI M100 didn't seem to reap the same benefits as those who were more invested in the course. Individual motivation seemed to be a key factor. One student in particular seemed to not be quite as engaged as some of the others, although she attended class regularly and turned in the majority of assignments on time. This student was very honest in her blogs about her own lack of motivation. She commented, "I think studying a little everyday would definitely be more helpful than just three days before the exam, but time and motivation always seem to get in the way." When discussing a new study method she also stated, "…I don't think I will ever really do that. Partly because I am lazy." The student repeatedly stated that she could see the value in using a particular method to learn, but often she lacked the motivation to use it consistently on her own. A student's lack of motivation to do the things that will help them most can be rather frustrating for an instructor, but it is also an issue that has occurred nearly every semester MSCI M100 has been taught. There always seem to be students who understand what they should be doing in order to be successful, yet they are not motivated enough to actually do it.

In addition to lack motivation, some students seemed to be unreachable. A different MSCI M100 student was enrolled in Anat A215 for the second time, yet she seemed to just not "get it." Late in the summer she discussed in a blog about how she hadn't performed very well on the third anatomy lab and lecture exams and couldn't figure out why. She said, "I honestly don't know how to study for this class because my methods of making flash cards and reading the book over and over isn't helping." At first, it may appear almost shocking that this student seemed to have no idea how to study for anatomy. This student already took Anat A215 one time before, so it seems reasonable that their previous experience may have shed light on what might or might not be effective study methods. At this point in the summer, a variety of methods had been discussed and even practiced in class. Such methods included creating drawings, flow charts, memory matrices, self quizzes and even something as simple as creating an organized list. Even so, this student frequently arrived late to class or didn't attend at all, and she did not turn in many class assignments, so she missed valuable information. This student's experience demonstrates that improving one's learning is not a passive task. It requires effort from the student and a willingness to try new study methods. Trying new methods, especially with the possibility that they could benefit you seems like a worthwhile endeavor, yet some students appear to lack the ambition or motivation to do so. It is also possible that the student was struggling to break their bad habits and form new habits, or they were still struggling to truly recognize the ineffectiveness of their methods. Forming new habits is a difficult task, and students often hold tight to their old habits and remain in a comfort zone. Breaking out of this comfort zone requires the

student to acknowledge his or her own deficiencies and to actively work on overcoming them.

Future Directions for MSCI M100

The initial offering of MSCI M100 presented with numerous positive outcomes, and many of the observed challenges were a result of intrinsic motivation, or lack thereof, within select students. Those students who were engaged and motivated achieved the learning goals. This initial success has led to MSCI M100 being taught again in subsequent semesters, and it has become a regular course offering. In the next two chapters several assessments will be discussed in detail from the spring 2011, fall 2011 and spring 2012 semesters of MSCI M100. Other anatomy graduate students are now teaching MSCI M100, since the original course developers have progressed in their degrees. The growing education track in anatomy doctoral and masters programs provide a good pool of Associate Instructors, many of whom are excited by the possibility of teaching a course like this.

While MSCI M100 focuses on the learning of anatomy, it is hoped that students will integrate what they learn in MSCI M100 into other disciplines' coursework. The methods taught in MSCI M100 are not exclusively used to learn anatomy, and can be beneficial in learning many subjects. Students entering college are often not prepared for the challenges of college coursework, as indicated by the increasing need for remedial courses at the college level (Aud et al., 2011; Peter Riley Bahr, 2010; Boatman et al., 2010). If MSCI M100 is able to generate the desired outcomes for anatomy, there is potential for developing similar courses for other college classes. Another possibility would be expanding enrollment of MSCI M100 to include students in other science

courses such as chemistry or biology. While the course is currently taught in the context of anatomy, many of the techniques implemented in MSCI M100 could be utilized by students of other science courses.

This course also could be relevant for students pursuing graduate level science coursework. Shaping the learning process and becoming a better monitor of that process does not halt because a student has earned a bachelor's degree. Medical students and graduate students in a gross anatomy course encounter challenges and sometimes struggle to do well. Supplemental instruction courses, which are very similar to MSCI M100, have been developed for medical students at several universities to help them learn new ways to study and help review material (R. Blanc & D.C. Martin, 1994; R. G. Bridgham & S. Scarborough, 1992; Winston et al., 2010). A course like MSCI M100 may be beneficial for medical or other graduate students, even at this later point in their academic career.

In summation the pilot of MSCI M100: Improving Learning Skills in Anatomy was a success. As enrollment in the course has increased in subsequent semesters the instructors have continued to evaluate the course, and student feedback is highly valued. Chapter 5 will discuss the formal analysis of several assessments from the spring 2011, fall 2011 and spring 2012 semesters of MSCI M100.

Chapter 5: Analysis of MSCI M100: Improving Learning Skills in Anatomy

As discussed in the previous chapter, MSCI M100 (Improving Learning Skills in Anatomy) is a 1 credit hour course that is taught concurrently with Anat A215. The course aims helps students recognize and implement successful study methods for anatomy. Students continually assess the effectiveness of their own study methods, while also learning new study methods in the context of the material being covered in Anat A215. While informal assessments, such as student feedback in class or via email, have helped repeatedly shape MSCI M100, a formal assessment of its efficacy in helping students be successful in Anat A215 is also necessary. Several analyses were conducted to compare and contrast MSCI M100 students to those Anat A215 students who did not enroll in MSCI M100, and several MSCI M100 course assignments were analyzed to identify changes in student habits and metacognition over the course of one semester.

A pilot of the course, with a small enrollment of 5 students, was offered during the summer 2010 session. The course was taught again in the spring 2011 semester with increased enrollment (27 students), and later in the summer 2011 semester with a similar enrollment to the summer 2010 semester. MSCI M100 also was offered in the fall 2011 and spring 2012 semesters, in which enrollment increased to 40 and 41 students, respectively. Data from the spring 2011, fall 2011 and spring 2012 semesters were included in the following study, as the sample sizes from these semesters allowed for more reliable analysis.

Methodology

After receiving IRB approval from Indiana University (study # 1007001530), individuals enrolled in MSCI M100 were invited to participate in this study at the end of

the semester and prior to data analysis. Students were informed of the study and received a consent form from a 3rd party (Jackie Cullison, who is listed as a co-investigator of the study). Because I was the principal investigator and MSCI M100 instructor, I was not present in the room when Ms. Cullison reviewed, distributed and collected consent forms. Ms. Cullison remained in possession of the consent forms and was responsible for de-identifying data to maintain anonymity of individuals (per IRB guidelines). De-identification of data was completed in an attempt to reduce possible bias as I conducted the analysis. Analysis of all deidentified data did not begin until after all course grades were submitted to the IU Office of the Registrar.

The following course assignments were included in analysis:

- a metacognitive self-assessment survey given on the first and last days of class to assess changes in metacognition
- laboratory and lecture exam scores in Anat A215 of MSCI M100 students and students only enrolled in Anat A215
    - two regular course assignments (study logs and blogs) completed by students throughout the semester in MSCI M100 (analysis of the blogs is discussed in detail in chapter 6)

Each of these assessments is discussed in detail below.

MSCI M100 Metacognitive Self-Assessment Survey

A course similar to MSCI M100 was developed and taught in conjunction with anatomy and physiology at the University of Southern Indiana (USI) (Hopper, 2011). Students enrolled in the course at USI completed a questionnaire at the beginning and at the end of the semester which addressed skills and behaviors that are important for

academic success. Students reported statistically significant increases in 14 out of 40 of the survey items, demonstrating results such as improved self-efficacy and greater use of effective study strategies (Hopper, 2011). In August, 2011 I contacted Dr. Hopper, and she granted me permission to use and modify the survey as necessary. In the fall 2011 semester I modified the survey to better fit with the Indiana University courses (MSCI M100 and Anat A215). The modified survey was used to assess skills and behaviors of students at the beginning and the end of the semester in which they are enrolled in MSCI M100. Part 1 of the survey asked about typical demographic variables (gender, ethnicity, age, etc.), as well as extracurricular activities in which students may be involved. Part 2 of the survey asked students to rate their comfort with various aspects of the learning process using a 5-point Likert scale (1=not at all comfortable, 3=comfortable, 5=extremely comfortable). Part 2 also addressed how frequently students utilized various study methods and tools through another 5-point Likert scale (1=never, 3=once in a while, 5=almost always). In Hopper's version of the survey there were 40 questions in part 2 of the survey, and students responded using a 10-point Liker scale. For the sake of time and simplicity this section was cut down to 13 questions, which were edited to fit the courses at IU. The Likert scale was cut down to 5 responses, because it was decided that a 5 point scale was adequate.

Data were unavailable for MSCI M100 students from the summer 2010 through the fall 2011 semesters, as these classes were in progress or already completed prior to survey development. The MSCI M100 students enrolled in the spring 2012 semester completed the survey during the first and the final weeks of the semester, so an assessment of their metacognitive development over the course of the semester could be

performed. During the first class meeting the survey was titled the "early semester survey," and students were asked to predict their comfort with several aspects of learning anatomy and how frequently they anticipated they would utilize a variety of learning resources for anatomy. Students were told to base these predictions on their past experiences and the expectations they had generated for the course (Anat A215). On the last day of class students completed a version of the survey titled "late semester survey" in which they responded to questions with their actual comfort and habits after the entire semester had been completed. Both surveys were completed during class, and as with previous data, Jackie Cullison de-identified the surveys. The early and late semester surveys can be viewed in their entirety in Appendix H. A numeric code was assigned to the surveys in place of names so that individuals' early and late semesters could be matched. A total of 44 students completed the early semester survey, and 25 students completed the late semester survey. Twenty three students completed both the early and the late semester surveys. Statistical analysis compared the aggregate results of the early and late semester surveys using independent t-tests. Paired t-tests were run to compare the responses of the 23 students who completed both surveys. All statistical analyses were conducted with the statistical software package PASW Statistics 20, Release Version 20.0.0 (SPSS, Inc, 2011, Chicago, IL).

Comparison of M100 & Non-M100 Students' A215 Grades

Anatomy A215 lecture exam, lab exam and final course grades were collected for those students enrolled in MSCI M100, as well as all other Anat A215 students who were enrolled during the fall 2011, spring 2011, and spring 2012 semesters. Independent t-tests were used to compare anatomy grades on laboratory exams, lecture exams and

overall Anat A215 final grades between students enrolled in MSCI M100 and those students not enrolled in MSCI M100. Statistical analyses were conducted with the statistical software package PASW Statistics 20, Release Version 20.0.0 (SPSS, Inc, 2011, Chicago, IL). It was expected that students enrolled in MSCI M100 would demonstrate lower failure and withdrawal rates, and perform as well or better than anatomy students not enrolled in MSCI M100 (Belzer et al., 2003; Bridgham & Scarborough, 1992; Hopper, 2011).

MSCI M100 Study Logs & Blogs

Two regular course assignments given throughout each semester in MSCI M100 were evaluated to measure changes in students' abilities to monitor their own learning. Table 5.1 provides a summary of the course assignments to be analyzed, and following the table is a description of each assignment, when it was assigned, the assignment goal, and the, and hypothesized findings. It is important to note that while there are some hypothesized results, an inductive approach grounded in the data was utilized to assess the blogs. Such an analysis involves immersion within the data to generate a codebook from which new and unexpected themes may arise (Artinian, Giske, & Cone, 2009; Kennedy & Lingard, 2006).

Table 5.1
MSCI M100 Course Assignments

Assignment	When Assigned	Assignment Goal	Hypothesized Result of Analysis
Study Logs	Prior to each A215 lecture exam	Increase student awareness of when and where they are most productive	M100 students will become more aware of when and where they are productive and by the end of the semester better utilize their time
Blogs	Prior to each class meeting	Improve metacognitive awareness	Students will be more metacognitively aware of their habits and begin using more effective learning strategies

Study logs were an assignment adapted from Classroom Assessment Techniques by Angelo and Cross (1993). A sample study log is shown in Figure 5.1. Students recorded when and where they were studying, and they rated their productivity during that time on a scale ranging from one to four (Angelo & Cross, 1993). A rating of "1" was assigned to nonproductive time, in which students learned nothing or extremely little. A student used a "2" for low productivity, indicating they learned something but not much. Average productivity was assigned a "3" and indicated the student learned a fair amount. Lastly, a rating of "4" was used for high productivity in which a student learned a great deal. The descriptions for each of these ratings were discussed in further detail in class prior to the first set of logs being completed. For example, if a student was texting or play games on their phones or computers, surfing the internet, etc. while studying, they would likely be assigning a 1 or 2 for their productivity during that time frame (which rating would depend on whether or not they actually learned anything).

Figure 5.1
Blank Study Log

Productive Study-Time Log

Tuesday, January 31

Directions: (1) Enter any block of thirty minutes or more you spent studying anatomy today on the form below. If you started at 2 P.M. and ended at 2:40, use the lines next to 2:00 only. (2) Make a note of where you were studying. (3) Make sure to rate the productivity of each half-hour segment in the appropriate column, using the following scale

1 = Nonproductive	Learning nothing or extremely little
2 = Low productivity	Learning something but not much
3 = Average Productivity	Learning a fair amount
4 = High Productivity	Learning a great deal

Productivity Ratings	Time	Place	Productivity Ratings	Time	Place
	8:00 A.M			5:30 P.M.	
	8:30			6:00	
	9:00			6:30	
	9:30			7:00	
	10:00			7:30	
	10:30			8:00	
	11:00			8:30	
	11:30			9:00	
	12:00 P.M			9:30	
	12:30			10:00	
	1:00			10:30	
	1:30			11:00	
	2:00			11:30	
	2:30			12:00 A.M.	
	3:00			1:00	
	3:30			1:30	
	4:00			2:00	
	4:30			2:30	
	5:00			3:00	

Subtotal A: Hours of anatomy study rated at Level 1 =

Subtotal B: Hours of anatomy study rated at Level 2 =

Subtotal C: Hours of anatomy study rated at Level 3 =

Subtotal D: Hours of anatomy study rated at Level 4 =

Total hours spent studying anatomy today =

Students completed one study log per day, three days prior to each lecture exam in Anat A215. Courses similar to MSCI M100 have demonstrated improvements in students' time management from the beginning to the end of the course (Belzer et al., 2003; Blanc & Martin, 1994; Hopper, 2011; Winston et al., 2010). The study logs were analyzed to determine the percentage of study time students spent at each productivity

rating for each exam. These percentages were compared to determine if students were spending significantly more time at any of the productivity ratings (i.e., do they spend significantly more time at average productivity (3) than nonproductive time (1)?). The percent of time at each rating was also compared between exams to determine if students spent more or less time at the varying productivity levels studying for each of the four Anat A215 exams. The general trends within each semester were also compared between the spring 2011, fall 2011 and spring 2012 MSCI M100 classes.

Another regular assignment for MSCI M100 students was posting blogs (online journal entries) via Oncourse, IU's electronic course management system. These blogs address points of confusion in A215, how students attempted to clarify these points, planning, time management and reflecting on exams or other MSCI M100 course assignments. Each blog entry was due prior to every class session and all blogs were worth a total of approximately 20 percent of the possible points students may earn in the class. A topic for each blog entry was provided by the instructor, and students then posted their responses, which could be read only by the instructor. These blogs aimed to prompt self-assessment of current anatomical knowledge and to help students develop a roadmap of how to tailor their studying. Due to the extensive nature of the blog analysis, a detailed description of codebook development and coding results is discussed in the following chapter.

Results

Survey: Part 1 – Demographic Information

The early semester survey was administered on the first day of class during the Spring 2012 semester. A total of 44 out of 49 students who were initially enrolled in MSCI M100 completed the early semester survey. Three out of these five students who did not complete the survey remained enrolled in the course, two of whom completed the late semester survey. The two students who did not complete the early semester survey withdrew from MSCI M100. Table 5.2 summarizes the early and late semester results of part one of the survey.

Table 5.2
MSCI M100 Spring 2012 Survey Results: Part 1

Characteristic		Early Semester Survey (% of students, n=44)	Late Semester Survey (% of students, n=25)
Gender	Female	84.1	84
	Male	15.9	16
Ethnicity	Caucasian	95.45	92
	Asian-American	2.3	4
	African-American	2.3	4
Class Standing	Freshman	36.4	40
	Sophomore	45.45	44
	Junior	13.6	12
	Senior	4.55	4
Age	18-19	56.8	64
	20-21	40.9	36
	22+	2.3	0.0
First-Generation College Student	Yes	22.7	8.0
Regular Family Contact	1-2 times per week	11.4	20.0
	~4 times per week	20.5	8.0
	Daily	65.9	72.0
Job	On-campus	15.9	12.0
	Off-campus	29.5	4.0
Work hours/week	<10 hours per week	18.1	12.0
	10-20 hours per week	18.1	24.0
	20-30 hours per week	6.8	0.0
Hours studying per week	1-2 hours	18.1	16
	3-6 hours	38.7	36
	7-10 hours	29.5	28
	10+ hours	13.7	20

At the beginning and end of the semester, most students who filled out the survey were female and Caucasian, and over half were freshmen or sophomores. All students who completed the survey were enrolled full-time (at least 12 credit hours), but over 80%

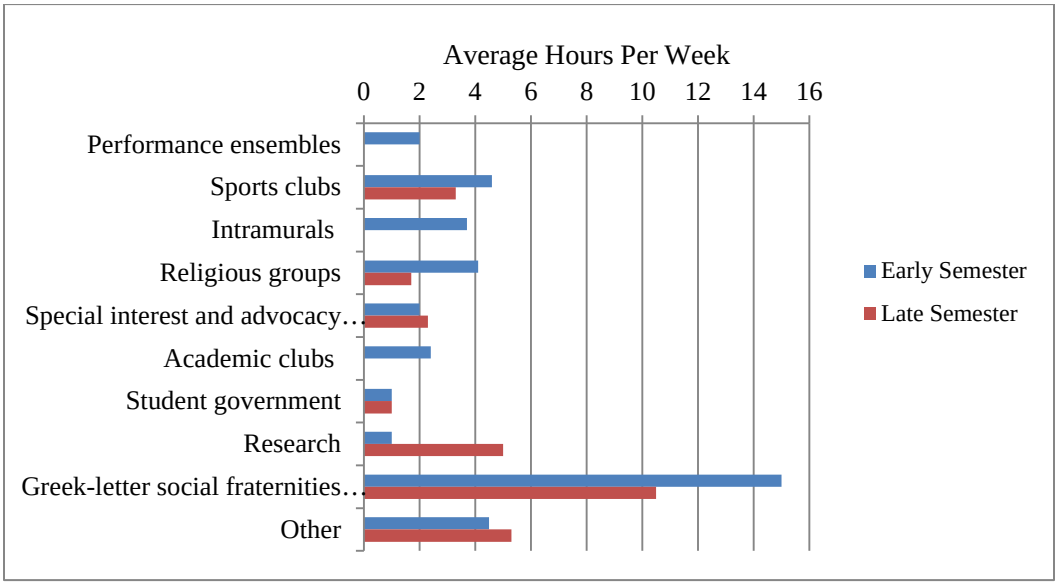
of the students predicted they would spend fewer than 10 hours per week studying for Anat A215 (a 5-credit hour course). Additionally, 10 students reported that they were the first member of their immediate family to attend a 4-year undergraduate institution. Most students reported daily contact with at least one family member throughout the semester, while the remaining students' contact with family ranged from contact 1-2 times per week to approximately 4 times per week (1 student did not respond to this item).

Also included in Table 5.2 is whether or not students had jobs and how many hours per week they worked. Most students did not hold a job during the spring 2012 semester, and among the students with jobs, most jobs were off-campus positions. Most of these students worked 20 hours or less per week. One student reported that they held an on-campus job, as well as an off-campus job. At the end of the semester there were similar trends observed. Few students had a job during the semester, and those that did worked 20 hours per week or less. A greater percentage of students who completed the late semester survey and had jobs were working on campus instead of off-campus.

Question 10 of the survey asked students to report the number of hours, if any, they spent participating in a number of other extracurricular activities on campus. Figure 5.2 demonstrates the average hours per week students spent in various extracurricular activities at the beginning and the end of the semester. Overall students reported a greater number of hours per week in which they were involved in extracurricular activities early in the semester than late in the semester. Even so, nearly half of the students who completed the early semester survey reported no extracurricular activities of any sort. Most common was involvement with Greek fraternities and sororities, in which students averaged 15 hours per week. Other commonly cited activities included sports

clubs and religious groups, and several students indicated they spent, on average, 4.5 hours each week involved with “other” activities, such as exercise, volunteering and mentoring. The average number of hours spent in extracurricular activities was generally lower late in the semester, and the most commonly reported activity was again, participation in Greek sororities and fraternities. Students reported spending slightly more time involved in “other” activities, and the average amount of time spent in research is more than double what students indicated early in the semester.

Figure 5.2
MSCI M100 Student Extracurricular Involvement Early and Late in the Semester



Survey: Part 2 – Comfort with the Learning Process & Use of Learning Tools

Part 2 of the survey addressed students comfort with various aspects of the learning process and asked students to predict how frequently they would be utilizing various study methods and resources. Students responded to questions 1-8 of this section using a 5-point Likert scale (1=not at all comfortable, 3=comfortable, 5=extremely comfortable). Table 5.3 shows the mean Likert scale response from responses to

questions 1-8 in both the early and late semester surveys. Detailed results indicating the frequency of responses for each survey response option on the early and late semester surveys can be found in Appendix I.

Table 5.3
Comparison of Early and Late Semester Comfort Levels

Survey Question	Early Semester Mean Response	Late Semester Mean Response
1: Asking questions in lecture	2.66	3.04
2: Asking questions in lab	4.30	4.76
3: Locating academically useful resources	3.43	3.64
4: Identifying useful strategies for learning	3.30	3.64
5: Self-assessing knowledge	3.45	3.32
6: Keeping course materials organized	4.11	3.80
7: Managing time	3.18	3.04
8: Synthesizing and applying information presented in class	2.73	3.00

Likert Responses: 1=not at all comfortable, 5=very comfortable

As shown in Table 5.3, in general, students were more comfortable asking questions in lab and lecture at the end of the semester than they were at the beginning of the semester. They also were more comfortable locating useful resources and identifying strategies that were useful for learning, as well as synthesizing and applying information presented in class. It is difficult to say whether this is the result of being enrolled in MSCI M100, or if this increased comfort pertains to increased familiarity and comfort overall with Anat A215. Regardless, it is a positive trend, because being comfortable with these aspects of the learning process are beneficial to learning.

The mean response for survey questions 5, 6, and 7 suggest students were less comfortable with organization and time management at the end of the semester than they were early in the semester. They also reported being slightly less comfortable self-assessing their knowledge at the end of the semester. These decreases in comfort with these aspects of learning may be the result of the increasing difficulty of Anat A215 (the second and third exams are more difficult than the first exam). It may also be explained by the time of the semester in which students completed the late semester survey. Final exams were fast approaching, so it is possible that the students had a heavy workload at the time and were feeling overwhelmed. This is compared to the beginning of the semester when students are just starting fresh after winter break and the intensity of their courses has yet to reach full impact. It is also possible that as metacognitive awareness increases, so does students' awareness of their disorganization.

Early in the semester, students were asked to predict how frequently they expected to utilize various study resources or methods throughout the semester in Anat A215 for questions 9-13 in part 2 of the survey. The same questions were re-worded for the late semester survey so that they would reflect actual (instead of predicted) student use of the resources and methods. Table 5.4 shows the mean responses to each of the Likert-scale response options (1=never, 3=once in a while, 5=almost always) for questions 9-13 in part 2 of the early and late semester surveys.

Table 5.4
Comparison of Early and Late Semester Use of Learning Resources

Survey Question	Early Semester Mean Response	Late Semester Mean Response
9: Review the instructors notes in regular week	3.64	2.96
10: Supplement learning with other resources	3.50	3.52
11: Study with partner or group for lecture	2.97	2.84
12: Study with partner or group for lab	3.91	3.36
13: Use publisher-provided support	3.36	3.36

Likert Responses: 1=never, 5=almost always

Mean responses to questions 9, 11 and 12 decreased from the early semester survey to the late semester survey. This suggests regularity with which students reviewed the instructor's notes each week and how frequently students studied with a partner or group for lecture or lab decreased. The mean responses on the early and late semester surveys for question ten and thirteen are nearly identical, suggesting students' use of other resources and publisher-provided materials to supplement their learning is consistent throughout the semester.

A total of 23 students completed both the early semester survey and the late semester survey, and the mean responses on both surveys are shown in Table 5.5. Paired t-tests were used to compare these students' responses to part two of the survey. There were no statistically significant differences found for when comparing early and late semester responses on questions 1-8 (in Part 2). The same analyses were conducted on survey questions 9 through 13 in part 2 of the survey, and the only significant t-test result was for question 9 ($t=1.036$, $p<.007$), which asked students how often they review the

instructor's posted notes during a regular (non-exam) week. The mean early in the semester was 3.57, compared to 2.96 late in the semester.

Table 5.5
Mean Survey Responses of Students Who Completed Both the Early and Late Semester Surveys (n=25)

Survey Questions	Early Semester Mean Response	Late Semester Mean Response
Part 1 of Survey		
1: Asking questions in lecture	2.91	3.04
2: Asking questions in lab	4.43	4.83
3: Locating academically useful resources	3.22	3.61
4: Identifying useful strategies for learning	3.26	3.57
5: Self-assessing knowledge	3.39	3.30
6: Keeping course materials organized	3.96	3.78
7: Managing time	3.04	2.91
8: Synthesizing and applying information presented in class	2.83	3.00
Part 2 of Survey		
9: Review the instructors notes in regular week	3.57	2.96
10: Supplement learning with other resources	3.65	3.52
11: Study with partner or group for lecture	3.00	2.83
12: Study with partner or group for lab	3.87	3.30
13: Use publisher-provided support	3.23	3.39

The mean responses observed in Table 5.5 showed similar trends as previously discussed. Two slightly different trends were observed on survey questions 10 and 13. In the aggregate analyses (Tables 5.3 and 5.4) there was essentially no change in mean responses for these questions. When comparing only the students who completed both

the early and late semester surveys there was a decrease in the mean response for question 10 on the late semester survey, suggesting they did not supplement their learning with other resources as frequently as they had predicted on the early semester survey. The increase observed in the mean response for question 13 on the late semester survey suggests that students were utilizing publisher-provided support more frequently than they predicted in the early semester survey. Paired t-tests did not show a statistically significant change for either of these questions.

Study Logs

As previously described, MSCI M100 students completed study logs as a method for raising students' awareness of their good and bad time management habits. Students completed one study log per day, three days prior to each lecture exam in Anat A215. The logs were analyzed to analyze aggregate trends, specifically whether or not time management and productivity changed throughout their enrollment in MSCI M100. Students reported the number of hours spent at each productivity rating for the three days prior to lecture exams. The number of hours spent at each rating for each exam was summed and converted to percentages. This allows for a more useful comparison between ratings (e.g., the percentage of time spent at a rating of 1 versus 3), as well as comparing the percentage of time spent at each rating on different exams. For example, students spent 25% of their time at low productivity (2) for exam 1, while only 20% of their time at the same rating for exam 2.

The percentage of time students spent studying at each productivity rating is found in Table 5.6. There is a consistent decrease in the percentage of time students spent studying at nonproductive or low productivity ratings (1 and 2) from the first to the

third lecture exam. From the first to the second lecture exam, students spent slightly greater percentages of their study time at higher productivity levels (3 and 4), and although there was a decrease in average productivity (3) on the third exam, there was a very large increase reported at high productivity (4) for the same exam. Paired t-tests revealed several significant differences between exams. A significant difference spent at low productivity rating (2) was found between exams one and three (t=2.29, p=.032). Statistically significant differences were also found for time spent at high productivity (4) between exams one and three (t=3.05, p=.006), as well as between exams two and three (t=3.00, p=.007).

Table 5.6
Spring 2011 Study Logs: Mean Percentage of Time at Each Productivity Rating per Exam

Productivity Rating	Lecture Exam 1 (n=26)	Lecture Exam 2 (n=26)	Lecture Exam 3 (n=24)
1: nonproductive	2.90	0.18	0.35
2: low productivity	19.86	14.37	9.38
3: average productivity	39.15	42.49	31.24
4: high productivity	38.08	42.95	59.03

In the fall 2011 semester the trends for nonproductive studying and low productivity were very similar to the spring 2011 trend for the first three lecture exams. The average percentage of time students in the fall 2011 semester spent at each productivity rating for each exam is shown in Table 5.7. From the first to the third exam, there is a consistent decrease in the percent of time spent at the low productivity ratings. Unlike the spring 2011 semester, MSCI M100 students in the fall 2011 and spring 2012 semesters also completed study logs for the fourth Anat A215 lecture exam. There was

an observed increase in both of these low ratings on the fourth exam. There is some variation in the higher productivity ratings over the course of the first three exams, but there was a decrease in time spent at both of these ratings on the fourth exam. Paired t-tests revealed statistically significant differences in the percentage of time spent at low productivity (2) ratings for exams one and three (t=2.29, p=.031) in which the students reported spending less time at this rating on exam three. A statistically significant difference was also found between exams one and two for high productivity. Students rated 35.59% of their time studying at high productivity for exam one, and this increased to 45.90% on exam four.

Table 5.7
Fall 2011 Study Logs: Mean Percentage of Time at Each Productivity Rating per Exam

Productivity Rating	Lecture Exam 1 (n=43)	Lecture Exam 2 (n=33)	Lecture Exam 3 (n=28)	Lecture Exam 4 (n=37)
1: nonproductive	3.06	1.75	1.41	2.16
2: low productivity	16.93	14.76	10.79	17.00
3: average productivity	44.95	38.28	45.35	40.88
4: high productivity	35.06	45.21	42.45	39.97

The study log trends observed in the spring 2012 semester are very similar to those observed in previous semesters, and the mean percentages of time at each productivity rating for each exam are shown in Table 5.8. Nonproductive and low productivity hours consistently decreased from exam one until exam three. Then a slight increase in the number of hours at these ratings was shown for the fourth exam. There was not much variation in the number of hours spent at average productivity. The

percentage of hours for high productivity increases slightly over the course of the first three exams, and then decreases for the final lecture exam. T-tests revealed no statistically significant differences between exams in the spring 2012 semester. Paired t-tests comparing time spent at each productivity level in the spring 2012 semester revealed that students spend significantly less time being nonproductive (1) than any other rating (p=.000). They also spend less time at low productivity (2) than at average or high productivity (3 or 4) (p=.000). There is not a significant difference between the percentage of time spent at average and high productivity (3 and 4, respectively).

Table 5.8
Spring 2012 Study Logs: Mean Percentage of Time at Each Productivity Rating per Exam

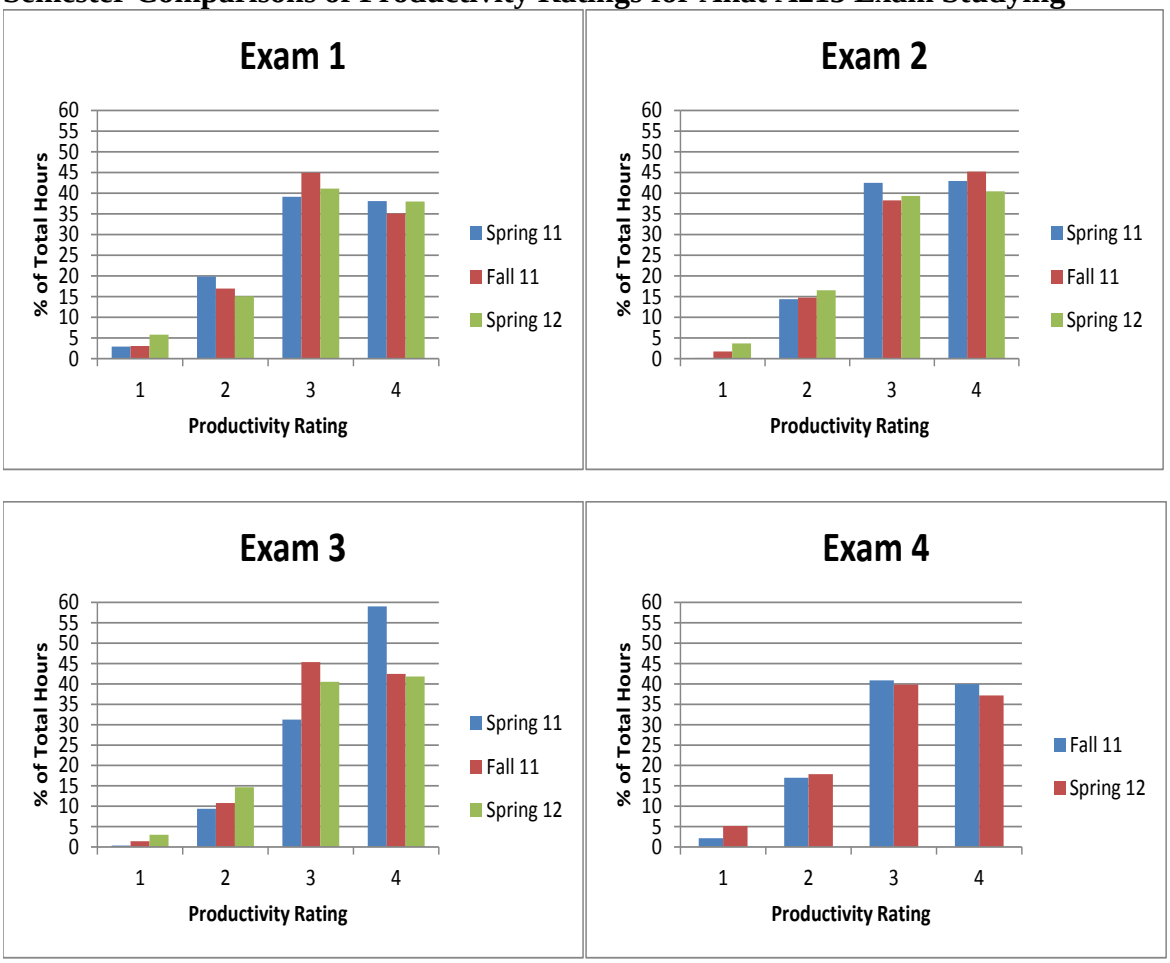
Productivity Rating	Lecture Exam 1 (n=41)	Lecture Exam 2 (n=39)	Lecture Exam 3 (n=38)	Lecture Exam 4 (n=35)
1: nonproductive	5.79	3.68	3.01	5.13
2: low productivity	15.08	16.53	14.66	17.86
3: average productivity	41.12	39.34	40.51	39.85
4: high productivity	38.01	40.45	41.82	37.16

Overall Study Log Trends

A visual comparison of study log trends from each semester, specific to each exam, is shown in Figure 5.3. Overall, students spent the smallest percentage of their time being nonproductive, followed by low productivity. The percentage of hours spent at average and high levels of productivity is very close for most exams in any given semester. There was a drastic increase in time spent at high productivity in the spring 2011 semester, and such a spike was not observed in subsequent semesters. The fall 2011 and spring 2012 semesters were very similar in the breakdown of time spent at each

productivity rating, but the spring 2012 percentages of study time at each rating were more consistent from exam to exam than other semesters.

Figure 5.3
Semester Comparisons of Productivity Ratings for Anat A215 Exam Studying



Students in the Spring 2011 semester did not complete study logs for Anat A215 exam 4, hence they are not included in the figure.

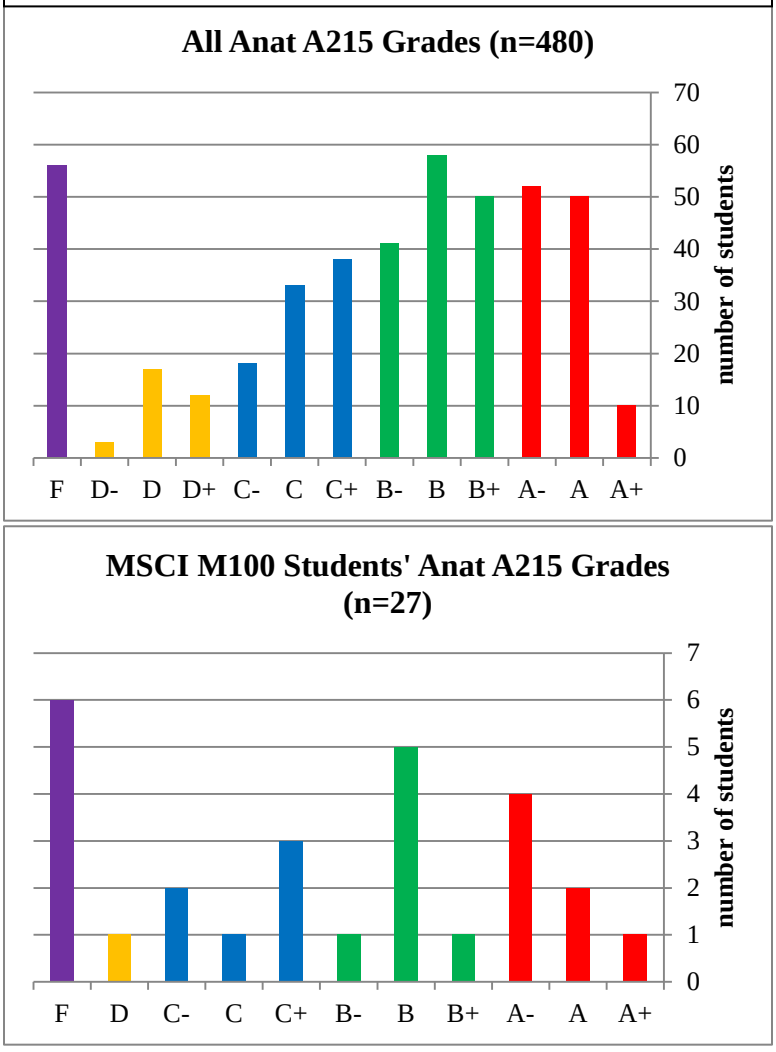
Grade Comparisons between MSCI M100 & Non-MSCI M100 Students

Anat A215 grades for all students were collected for the spring 2011, fall 2011 and spring 2012 semesters. Independent t-tests were run to determine if there were statistically significant differences in lecture exam grades, lab exam grades and overall point totals between students enrolled in MSCI M100 and students not enrolled in MSCI M100. The only statistically significant results that were generated were for the first and

second Anat A215 lab exam in the spring 2012 semester (t=2.38, p=.020 and t=3.11, p=.003, respectively). On the first lab exam MSCI M100 students earned an average score of 84.57 percent and non-MSCI M100 students earned an average of 80.01 percent. For the second lab exam, students in MSCI M100 earned an average score of 88.14 percent, while students not enrolled in MSCI M100 earned only 81.5 percent.

Further comparisons were made between final Anat A215 course grades of MSCI M100 students and students not enrolled in MSCI M100. This comparison was made for spring 2011, fall 2011 and spring 2012 semesters. Figure 5.4 displays the Anat A215 final grade distribution and the MSCI M100 students' Anat A215 final grade distribution. Overall, the MSCI M100 students' Anat A215 grade distribution is very similar to the distribution overall for Anat A215. The distribution for MSCI M100 students is slightly closer to a normal curve, compared to the negative skew of the overall Anat A215 distribution. This suggests that the mean course grade would be slightly lower amongst the MSCI M100 students.

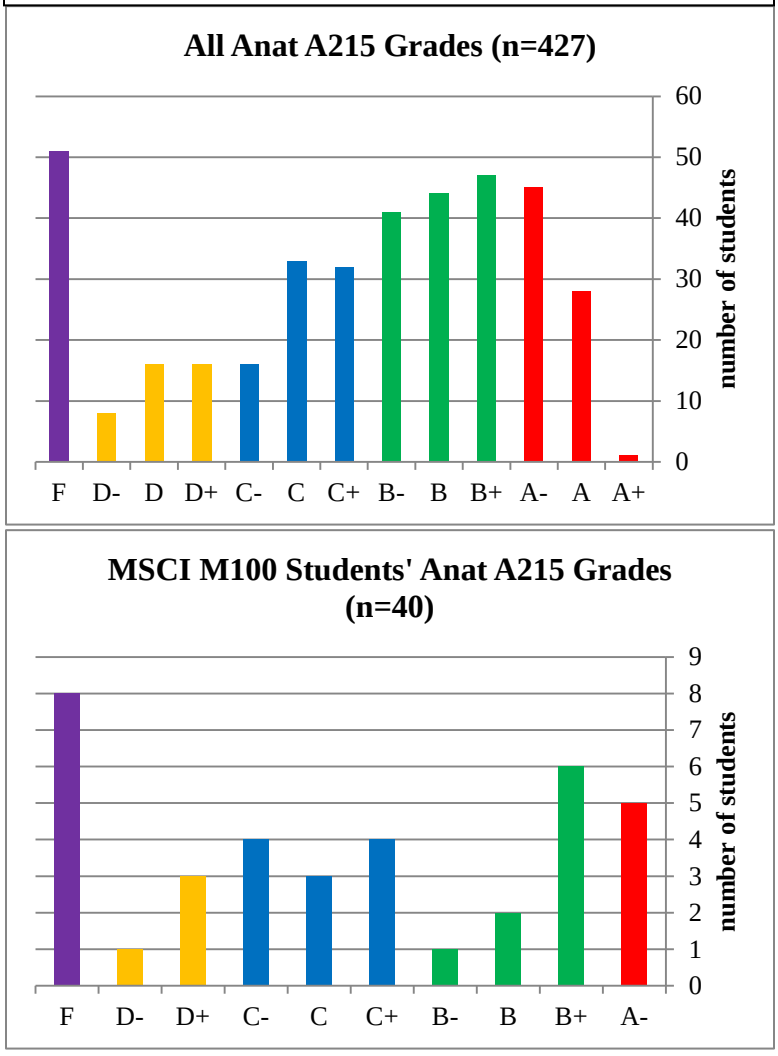
Figure 5.4
Comparison of Spring 2011 Anat A215 Final Grade Distributions



The same comparisons in grade distributions were made for the fall 2011 semester (Figure 5.5). The overall Anat A215 final grade distribution observed in the fall 2011 is very similar to the spring 2011 Anat A215 final grade distribution. The fall 2011 MSCI M100 students' Anat A215 final grades are multimodal. There is a peak at final grades of A-/B+, a slightly lower peak in the C range and a large peak of Fs. This is still fairly

similar to the overall Anat A215 final grade distribution which is negatively skewed with the peak in the B+/A- range, and then a spike in the number of students who earned an F.

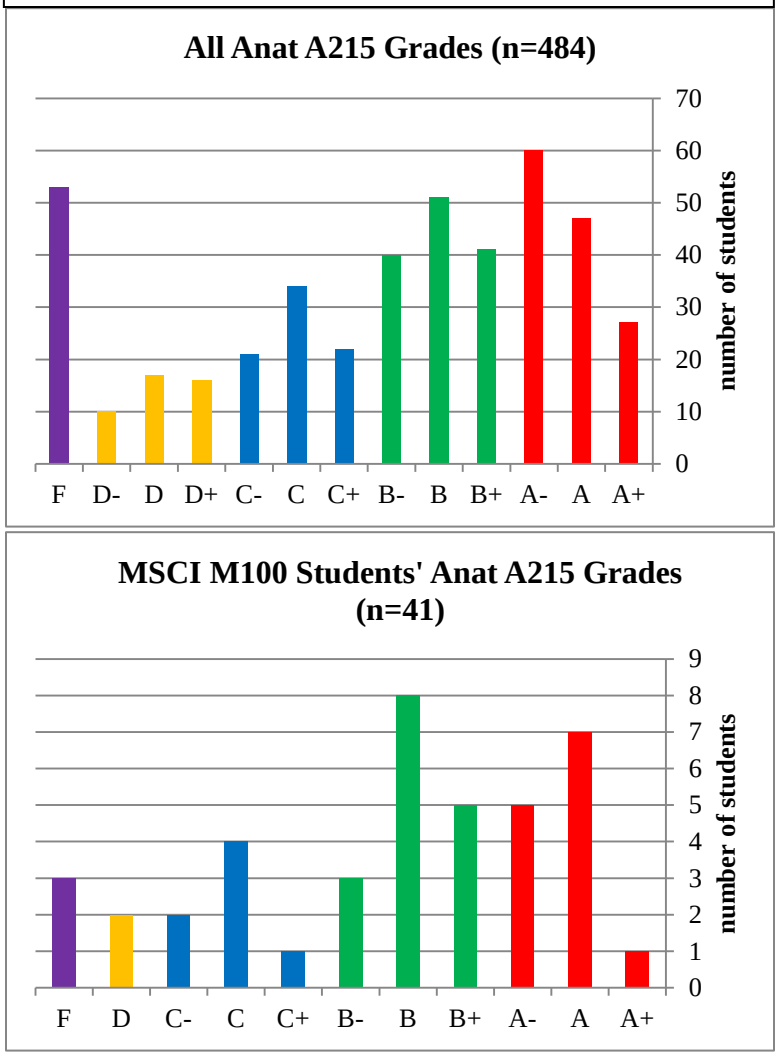
Figure 5.5
Comparison of Fall 2011 Anat A215 Final Grade Distributions



Again, the final grade comparisons were made for the spring 2012 semester (Figure 5.6). The overall Anat A215 final grade distribution was *positively* skewed, with a spike in the number of Fs. The MSCI M100 students' distribution of Anat A215 grades was more similar to the overall distribution than any other semester. Also, there were far

fewer Fs earned in Anat A215 by the spring 2012 MSCI M100 students than observed in the previous semesters. This may be explained by a combination of factors. First was the MSCI M100 instructor's experience. The spring 2012 was the instructor's fifth time teaching MSCI M100. Her effectiveness as an instructor likely increased, resulting in improved student results. Another factor was the student population in MSCI M100. These students may have been more actively engaged in the process of improving their metacognitive awareness, as well as learning new study skills. This could have then resulted in an increased number of students earning higher grades in Anat A215. It is also possible that there were fewer students enrolled in MSCI M100 who were at risk for earning lower or failing grades in Anat A215.

Figure 5.6
Comparison of Spring 2012 Anat A215 Final Grade Distributions



Final course grades were also analyzed to determine Anat A215 failure and withdrawal rates. Table 5.9 demonstrates the number of students who failed or withdrew from Anat A215, as well as the number of MSCI M100 students who failed/withdrew from Anat A215. In both 2011 semesters the Anat A215 failure rate of MSCI M100 students was nearly double the overall Anat A215 failure rate. In contrast, no MSCI M100 students withdrew from Anat A215 in the spring 2011 semester and the withdrawal rate in the fall was less than half of the Anat A215 withdrawal rate. In the spring 2012

semester there were no MSCI M100 students who withdrew from Anat A215, and the percentage of MSCI M100 students who failed anatomy was lower than the Anat A215 overall failure rate.

Table 5.9
Anat A215 Failure & Withdrawal Rates

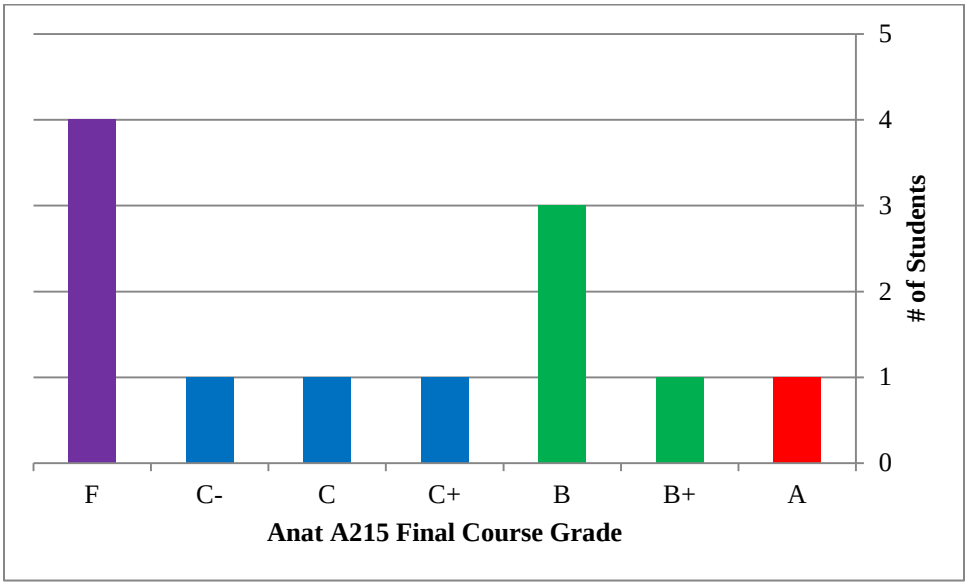
Semester		Anat A215	MSCI M100
Spring 2011	Failed Anat A215	56/480 (11.7%)	6/27 (22.2%)
	Withdrew (from Anat A215)	42/480 (8.8%)	0/27 (0.0%)
Fall 2011	Failed Anat A215	51/427 (11.9%)	8/40 (20.0%)
	Withdrew (from Anat A215)	49/427 (11.5%)	2/40 (5.00%)
Spring 2012	Failed Anat A215	53/484 (11.0%)	3/41 (7.3%)
	Withdrew (from Anat A215)	45/484 (9.3%)	0/41 (0.00%)

Interestingly, two students in the fall 2011 semester withdrew from Anat A215, but remained enrolled in MSCI M100. One of the course goals for MSCI M100 is for students to be able to transfer the skills they learn in this course to their future coursework, and although it is taught through the context of anatomy, it is reasonable that a student could take the course while not enrolled in anatomy but still learn valuable skills to be applied to other coursework. These two withdrew near the second set of Anat A215 exams. Both students continued to turn in their work for MSCI M100, although as the semester continued they turned in fewer and fewer assignments. Both students passed the course, but with grades well below the class average.

In addition to these two instances, there were several cases in which students withdrew from both MSCI M100 and Anat A215. There were also students who only

withdrew from MSCI M100. Over the course of the three semesters include in this analysis there were eight students who withdrew from MSCI M100 and Anat A215. An additional 12 students withdrew from MSCI M100 but remained enrolled in Anat A215. The success of MSCI M100 students who remained enrolled in Anat A215 in these semesters was quite variable. Figure 5.7 shows the final Anat A215 course grades of students who withdrew from MSCI M100. Most students earned grades that would not be sufficient to be a competitive applicant for allied-health programs, and several earned final grades that would not be sufficient for meet most program requirements (such as for athletic training).

Figure 5.7
Anat A215 Final Course Grades of Students who withdrew from MSCI M100



Comparing MSCI M100 & Anat A215 Final Grades

The last comparison of grades was within the MSCI M100 student population. MSCI M100 final course grades were matched with individual students' Anat A215 final course grades. These grades were compared to determine if students frequently did well in both courses, or if there were frequent discrepancies. Table 5.10 shows these comparisons for each of the semesters included in previously discussed analyses. In all three semesters it was not unusual for students to earn an A in MSCI M100, while earning a B in Anat A215. This is not surprising or reason for concern, and it can be explained by a couple factors. The first factor is the difficulty of each course. MSCI M100 is a 1 credit-hour course, and it is not nearly as challenging as Anat A215. A grade within the B range for Anat A215 is still suggests a student was successful in a rather challenging course. These factors make it interesting to see students earned an F in MSCI M100 and an A or B in Anat A215 in the Spring 2011 semester. It is possible that these students did not see value for themselves in MSCI M100, therefore they did not complete the assigned work. The comparisons in the fall 2011 semester more closely match the expected results. It is expected that students who earn a higher grade in MSCI M100 would also earn higher grades in Anat A215. This trend becomes even stronger in the spring 2012 semester.

Table 5.10 Comparing MSCI M100 Final Grades to Anat A215 Final Grades

Spring 2011

	Anat A215 grade				
MSCI M100	**A**	**B**	**C**	**D**	**F**
A	4	5	4		2
B	2	1		1	2
C			2		
D					1
F	1	1			1

Fall 2011

	Anat A215 grade				
MSCI M100	**A**	**B**	**C**	**D**	**F**
A	3	6	6	3	2
B	2	3	2	1	3
C			2		2
D					1
F			1		

Spring 2012

	Anat A215 grade				
MSCI M100	**A**	**B**	**C**	**D**	**F**
A	6	9	4	1	1
B	6	3	1	3	
C		2	1		2
D		1			
F					1

Discussion

Survey

The survey results revealed that the MSCI M100 student population is quite similar to the general Anat A215 student population with respect to demographics. The majority of the students in MSCI M100 are female, Caucasian, and full-time students enrolled in their freshman or sophomore years of college. This is not surprising, as the majority of Anat A215 students are also female, Caucasian, full-time students. Many of the students in Anat A215 are pursuing nursing, and these students need at least a B+ in Anat A215 to be competitive nursing school applicants. Many of these students likely enrolled in MSCI M100 in order to help themselves be successful in Anat A215 so they are able to earn a B+ or better. Also, as shown in Table 5.2, the demographic sample of students completing the early semester survey doesn't differ greatly from the demographic sample of students completing this survey late in the semester. The vast majority of MSCI M100 students are freshmen and sophomores, suggesting that even at a younger age, these students are able to recognize that they have room for improvement in their learning process.

Ten percent of MSCI M100 students reported they were the first member of their immediate family to attend a 4-year undergraduate institution. Previous studies have shown first-generation college students tend to be less persistent (essentially higher attrition rates), resulting in overall lower academic achievement and rates of degree attainment (Ishitani, 2003, 2006; Nunez & Cuccaro-Alamin, 1998).

Another factor associated with success is having a support network. Students with solid academic, social and personal support are more likely to persist in school (Tinto, 2002). Most students in MSCI M100 cited very regular contact with at least one

family member, suggesting they have a decent amount of support. Other researchers have found social support (family and friends) to be a positive predictor of student adjustment to college in their first year (Friedlander, Reid, Shupak, & Cribbie, 2007; Hurtado, Carter, & Spuler, 1996; Lapsley, Rice, & FitzGerald, 1990). Over one third of MSCI M100 students were in their first year of college, but the amount of family contact reported by students seems to indicate a good amount of family support. It is hoped that these students are undergoing a smooth transition to college, putting them in a better position to achieve academic success. Because the MSCI M100 population and Anat A215 population are so similar, it would not be surprising to find similar results in the Anat A215 students who were not enrolled in MSCI M100. Without have such data available it is difficult to determine if the spring 2012 MSCI M100 students had more or less contact with family than other Anat A215 students.

Although there were no significant t-test results for part 2 of the survey, most of the trends observed suggest students were becoming more comfortable asking questions in Anat A215 lecture and lab, locating useful academic resources, identifying effective learning strategies, and synthesizing and applying information presented in class. These trends may be attributed, at least in part, to students simply becoming more comfortable with Anat A215 itself. As they learn what is expected of them in this course and the logistics of the course it is not surprising that they would become more comfortable with these aspects of learning. Without a comparison between students in MSCI M100 and students who took Anat A215 without MSCI M100 it is difficult to determine how much of the observed trends can be attributed to students' enrollment in MSCI M100.

This survey was similar to the one developed by Hopper (2011). Hopper's results demonstrated increased scores in 38 of the 40 original survey items. The survey(s) in MSCI M100 were shorter, and the questions lined up with the 14 questions from Hopper's survey that demonstrated significant changes. Of the 13 items in part 2 of the MSCI M100 survey, six showed increases. These increases suggest increases in comfort or increased frequency of use of certain resources.

It is important to note survey and course differences between Hopper's course and MSCI M100. In the original Hopper survey a 10-point Likert scale was used for responses, and the survey administered in MSCI M100 utilized a 5-point scale. Also, Hopper's course is open to all anatomy and physiology students, but it is required for all remediating students. In contrast, enrollment in MSCI M100 is voluntary for all Anat A215 students. While there were some remediating students enrolled in MSCI M100 each semester, the majority of the class was taking Anat A215 for the first time. The survey results would likely have been different if remediating students were required to enroll. It is likely that there would have been more room for improvement in a greater number of aspects of learning. Not only would there have potentially been a greater number of increases on the mean survey responses, there would have possibly been a greater number of significant changes.

There are some limitations with the survey analysis completed for MSCI M100. First and foremost, the results presented are based on data collected from a single semester of MSCI M100. Survey responses from multiple semesters would help to increase the reliability of the results. Additionally, the number of students who completed both the early and late semester surveys is limited (n=23). A greater response

rate on both surveys would also increase the reliability of the statistical analysis and reduce potential nonresponse error (Groves et al., 2009). Lastly, the survey is a self-reported measure. It is assumed that students are honest in their responses, and that their assessments and estimations of the time spent in various activities, as well as comfort partaking in different aspects of the learning process are accurate.

Study Logs

According to the study log analysis, students rate most of their study time at average productivity (3) or being highly productive (4), and the amount of time spent at lower productivity consistently decreases over the course of the first three exams. This suggests students are improving in their abilities to manage their time effectively, spending increasing amounts of time being more productive. The observed increase in the percentage of time spent at lower productivity for the last exam could be explained by a number of factors. The fourth lecture exam in Anat A215 is during finals week. At this point in the semester students often have a heavy workload with exams and projects in many of their classes. Also, as mentioned by several students in the spring 2012 semester, at the end of the term many students feel burnt out and their motivation to study is lower than it had been earlier in the semester. This may have resulted in decreased levels of focus, therefore lowering their productivity.

The study logs have been a useful tool, but there are limitations to consider when interpreting results of this analysis. First is that the study logs are a self-reported measure. As with the survey, it is assumed that students are honest when completing the logs. Also, the process of rating one's productivity is a subjective endeavor. While time is taken in class to describe what each rating means and students are able to ask questions

to clarify when a 2 (low productivity) is appropriate versus a 3 (average productivity), there is likely variation from one individual to the next in the rating process. Lastly, students in the spring 2011 MSCI M100 class did not complete study logs for the fourth Anat A215 exam. This restricts the comparisons that can be made across the three different MSCI M100 semesters in this study.

Final grade & Withdrawal Rate Comparisons

Comparison of grades, failure rates and withdrawal rates did not reveal great differences in achievement between students enrolled in both MSCI M100 and Anat A215 and students not enrolled in MSCI M100. Several students withdrew from MSCI M100 while remaining in Anat A215. When a student withdraws from MSCI M100 it is typically assumed that the student does not feel the course is necessary/beneficial to their success in Anat A215. It is then expected that these students would be capable of success in Anat A215 on their own. This does not seem to be the case, as one third of these students still failed Anat A215 and at least half did not earn grades high enough for their program of study or admission into the school in which they hope to complete their studies. It is possible these students did not recognize their own need for assistance, or that MSCI M100 could help them. Previous studies have shown that low-achieving students also have lower metacognitive awareness than high-achieving students (Garrett et al., 2007; Naug et al., 2011). This relates to an observation by MSCI M100 instructors. Each semester the student population in MSCI M100 seems to be rather dichotomous. There are motivated, high-achieving students who will likely succeed in Anat A215 regardless of whether or not they enrolled in MSCI M100 and lower-achieving students who seem to lack motivation to put forth enough effort to do well in either course.

Previous studies have shown positive correlations between academic achievement and metacognition, and although, these high-achieving MSCI M100 students may still benefit from the course, they appear to already have decent metacognition (Lindner & Harris, 1992; Zimmerman & Martinez-Pons, 1990). The MSCI M100 course was developed with the intent of assisting students who lack the study skills and metacognitive awareness to be successful, and especially students who are remediating Anat A215. Although students with higher levels of metacognitive awareness can still benefit from the course, it is hoped that with each semester that MSCI M100 is offered there will be an increase in the number of students enrolled in the course with lower metacognitive awareness.

Overall, the results discussed in this chapter show positive trends. In particular, the results from the Spring 2012 are very positive, showing improvements in students' study habits and comfort with aspects of the learning process. As MSCI M100 continues to be taught there will be ample opportunities to develop upon the current analyses to better assess the impact of MSCI M100. One of the main course goals of MSCI M100 is to improve metacognitive awareness of students. In an attempt to better understand changes in students' metacognition over the course of a semester the weekly blogs completed in MSCI M100 were also analyzed. The following chapter will outline the development of a codebook which was used to analyze the blogs for trends in metacognition and study habits, as well as the results from coding the blogs from three different semesters.

Chapter 6: MSCI M100 Blogs Analysis

One of the primary MSCI M100 assignments used to help students become more metacognitively aware was the weekly blogs. Blogs are a reflective writing assignment was implemented because improving students' metacognitive skills is a course goal of MSCI M100. Prior to class each week, students completed a blog via Oncourse (IU's online course management system), the topic for which was provided by the instructor. Generally the blog topics revolve around assessing study methods, planning and time management, and reflecting upon exam performance. In an attempt to analyze changes in students' metacognitive awareness, as well as changes in their study habits a codebook was developed.

Methodology

Blog analysis involved developing a codebook based on the students' entries. The codes were utilized to reveal any themes among student comments about their learning experiences in MSCI M100 (Artinian et al., 2009; Creswell, 2012; Glaser, Strauss, & Strutzel, 1968; Kennedy & Lingard, 2006). This detailed analysis aimed to reveal changes in metacognitive awareness and study habits of students over the course of the semester in which they were enrolled in MSCI M100. Inductive analysis of this nature is widely used with qualitative data. Broad categories are generated from the data, with more specific themes within each category (Creswell, 2012; Glaser et al., 1968; Lingard & Kennedy, 2010). Qualitative data analysis is an iterative process, so after the initial categories and themes were developed, the blogs were reread multiple times to develop mutually exclusive subthemes that were used for coding the data (Lingard & Kennedy, 2010). Numeric codes were assigned to each subtheme, and the codes were

then used to indicate when a statement or segment of a statement in the blogs discussed a specific subtheme. The codebook was developed by the two MSCI M100 co-developers, Audra Schutte (AS) and J. Smith (JS). Also, Valerie O'Loughlin assisted in several iterations with fleshing out mutually exclusive codes. Upon completion of a draft of the codebook, the developers read 1-2 weeks' worth of blogs, assigning the appropriate code(s) to individual statements. The two sets of coded data were compared and discussed, and adjustments to the codebook were made to account for overlapping codes or inconsistencies between coders. This process of coding 1-2 weeks of blogs, comparing coder results and editing the codebook was reiterated several times, using different blogs for each iteration. As the scoring of codes became more consistent between coders, a Cohen's Kappa value was generated using the statistical software package PASW Statistics 20, Release Version 20.0.0 (SPSS, Inc, 2011, Chicago, IL). Cohen's Kappa is an index for measuring interrater reliability, and a Cohen's Kappa value ranging from .61-.80 typically represents substantial agreement between coders (Burla et al., 2008; Landis & Koch, 1977; Stemler, 2001). The test run of the final version of the codebook generated a Cohen's Kappa value of .743. This indicated there was strong interrater reliability between coders and thus, the codebook was ready for use.

The final version of the codebook can be found in Table 6.1. The major codebook categories were metacognition and study habits, which line up well with the MSCI M100 course goals. The metacognition category was broken down more specifically into the following themes: self-awareness of learning, self-efficacy and distractions from learning. The themes of "self-awareness of learning" was further divided into subthemes that addressed statements by students about their learning style,

effectiveness of a certain study habit(s) and whether or not they knew how best to prepare (Flavell, 1981; Garrett et al., 2007). Self-efficacy refers to a student's confidence in their ability to be successful, including their confidence in their study habits, test-taking abilities and the amount of effort put into studying (Bandura, 1993; Garcia & Pintrich, 1991). For this reason the "self-efficacy" theme was broken into subthemes addressing confidence in exam preparation and how well it matched the earned exam grade. The last theme within metacognition, "distractions from learning," was subdivided into the distractions most commonly cited by students in their blog entries.

The study methods category contained the following themes: time management, study tools and study methods. Time management was subdivided into subthemes that addressed students developing plans to utilize their study time or assessing how well they had been using their time (e.g., procrastinating, sticking to a schedule, etc.). Study tools and study methods initially overlapped, but the study tools subthemes specifically addressed what students utilized to study, such as their textbook or creating their own charts or drawings. In comparison, the study methods theme was subdivided into subthemes that referred to how students were approaching their studying. Examples of these methods include discuss chunking/grouping material, self-quizzing, or memorization.

Coding the blogs for analysis in this dissertation was conducted by only one of the codebook developers (AS). Blogs from each week were read, and the appropriate code was assigned to individual statements for the blogs from the spring 2011, fall 2011, and spring 2012 semesters. If a student discussed one topic throughout multiple sentences within one blog entry those statements were assigned a single code (versus assigning the

same code multiple times within one blog entry). During selected weeks of each semester, the blogs were used to as a means to determine what students found most challenging in Anat A215, or to assess what students found most beneficial or not beneficial in MSCI M100. Such blogs were used to provide the instructors insight so that they could shape in-class activities to better suit students' needs. Because these entries did not typically provide insight into students' learning process they were excluded from analysis.

Analysis of the codes was completed using the statistical software package PASW Statistics 20, Release Version 20.0.0 (SPSS, Inc, 2011, Chicago, IL). This process involved calculating the frequencies of the codes for each assigned blog. Codes will be discussed as a percentage of coded statements either within a given week's blog or within a segment (several weeks) of the semester. The following discussion will discuss elaborate on the results from each individual semester, and then summarize trends found consistently throughout semesters.

Table 6.1
MSCI M100 Blog Codebook

Category	Theme	Subtheme	Description
1.0 Metacognition			**Students describe various aspects of their own learning process.**
	1.1 Self-Awareness of Learning		
		1.1a Learning Style	Student describes their preferred or optimal learning style
			When a student describes the success of a particular study tool/method, or use of a new method one of the following codes should be used.
		1.1b Success of study methods	Description of successful use of study method(s)
		1.1c Unsuccessful study methods	Description of study method(s) which are not working well, or had no perceived impact
		1.1d New Study Method	The student describes changes to study methods, including trying a new method, consistent use of a new method or plans to make changes
		1.1e Confident about how to prepare	Student describes feeling prepared/certain about what is needed them to prepare for exams
		1.1f Not confident about how to prepare	Student expresses uncertainty about what is needed to be successful
		1.1g Lab & Lecture Overlap	Student expresses awareness of overlap between lab and lecture material
	1.2 Self-Efficacy		**These statements describe a student's confidence in their study habits, test taking abilities and generally the amount of effort put into studying.**
		1.2a Confident and performs well	The student feels confident in their study habits, test taking, or feels they put in lots of effort and performs well on exams
		1.2b Confident and performs poorly	The students feels confident in their study habits, test taking, or put lots of effort into studying but performs poorly or worse than they expected
		1.2c Not confident and performs well	The student lacks confidence in their study habits, test taking or put in little effort but performs well or at least better than expected on exams
		1.2d Not confident and performs poorly	The student lacks confidence in their study habits/test taking, or put in little effort and performs poorly on exams
		1.2e Effort=Grade	General statement about the student's efforts to prepare matching the exam grade earned.
	1.3 Distractions from Learning		

		1.3a Technology	Discussion of technological distractions that don't invovle communication with others, such as using phones or computers for surfing the web, playing games for individuals, watching tv or movies
		1.3b People	Friends or other classmates are a distraction, this may be communication in person or via technology (i.e. texting, Facebook, email, instant messenger)
		1.3c Courseload	A full courseload took attention away from anatomy
		1.3d Sleep	sleepiness made it difficult to pay attention in class or study outside of class
		1.3e Location while studying	Description of how a study location impacts studying
2.0 Study Habits			**Students describe a variety of topics related to their study habits.**
	2.1 Time Management		
		2.1a Effective time management	The student discusses use of effective time management strategies, such as setting a specific schedule, prioritizing duties or maintaining a balance between both academics and social obligations.
		2.1b Unspecific time management	The student discusses a vague, non-specific or general plan to utilize their time
		2.1c Ineffective time management	The student discusses use of ineffective time management such as procrastination, inability to stick to a schedule.
	2.2 Study Tools		**Students discuss various study tools they are currently using in their studying.**
		2.2a Laboratory tools	The student utilizes the tools available in lab to learn (virtual lab, virtual microscope, models, Anatomy & Physiology Revealed)
		2.2b Student prepared tools	The student creates their own study tools (charts, drawings, models, notecards, etc)
		2.2c Lecture/textbook tools	The student utilizes tools provided from lecture or the textbook (memory matrices, study guides, etc.), as well as instructor provided materials which are elaborated on both during and outside lecture
	2.3 Study Methods		
		2.3a chunking/grouping	The student attempts to learn by breaking material down into smaller groups or chunks
		2.3b Group work	The student works with others to learn
		2.3c Self-quizzing	The student quizzes themselves through the use of any of the tools provided in lab, lecture or self-created.
		2.3d Memorization	The student attempts to learn by memorizing material

Results

This chapter will focus on the blogs analysis from each semester of MSCI M100, including the spring 2011, fall 2011 and spring 2012. The results from each semester will be discussed individually, and the results section will end with a discussion of general trends noted throughout all semesters. The summer sessions in which MSCI M100 were taught were not included in this analysis due to the very small sample sizes from those classes.

Spring 2011

Spring 2011 was the first semester in which the blogs were analyzed, as student enrollment was large enough to allow for more reliable analysis. The topics for each week's blog entry can be found in Table 6.2. The topics are listed chronologically, and the topics can be grouped into three general topics: assessment of study methods, planning/time management, exam reflections. There are some weeks in which the blog entries were not included in analysis because the topics being discussed did not assess the students' individual learning process. For example, in week eight students provided feedback about likes/dislikes in the course. Blog topics were a bit more scattered in this semester. Based on student blogs throughout this semester, the MSCI M100 instructors were able to shape which blogs would be used more consistently in future semesters. Additionally, the wording of each posted blog topic was tweaked to better elicit the desired responses.

Table 6.2
Spring 2011 Blog Topics

Blog Topic Groupings: Assessing Study Methods, Planning/Time Management, Exam Reflection

Week of the Semester	Summary of Blog Topic
1	Reflection of in-class discussion
2	Habits during lecture and how that affects learning
3	Study plan for upcoming week, including dealing with distractions (i.e. Superbowl)
5	How studied for first exam, and what new methods to try for next exam
7	What is required to do well in A215
8	Mid-term MSCI M100 course evaluation
9	Reflect on study logs: when and where study best?
10	Plan of action for first week after spring break
12	What methods from MSCI M100 will be implemented for the last Anat A215 exam?
13	Reflection of in-class discussion
14	Use of textbook practice questions
15	Exam 3 reflection: grades match expectations? How study methods helped/hindered success? Changes to study habits?
16	MSCI M100 course evaluation

Table 6.3 shows the results of coding for three blogs which specifically addressed study methods in the Spring 2011. In Table 6.3, and the tables presenting coding results for the remainder of the chapter, the codes in which there were very large changes from the first to the second half of the semester are highlighted. The color used to highlight these results corresponds to the color coding used in tables presenting blog topics.

The results are shown as a percentage of coded statements within each half of the semester (each half is an 8 week period). Weeks 2 and 5 are in the first half of the semester, and week 12 was the only blog discussing study methods in the 2nd half of the semester. As shown in Table 6.3 the most notable changes were about discussion of study methods that do not work well for students. There were no comments made about this topic in the first half of the semester, but 12.5 percent of coded comments in the

second half of the semester were about this issue. It is possible students became better able to recognize and assess how effective different study methods were. Another large increase was seen in discussion of grouping/chunking as a study method. This method was discussed in MSCI M100 class sessions, so it is possible that exposure to this method in class prompted more discussion of it in blogs. The two largest decreases were observed in discussion about using new study methods and studying in groups. It was expected that during the second half of the semester the students would not be proposing new methods as frequently. In the first half of the semester students gained exposure to many different study methods, and it was essentially a period of trial and error. In the second half of the semester students have often found methods that work well for them. The decrease in discussion of group work may be due to students spending less time studying in groups. It could also be that their discussion was focused elsewhere. In the second half of the semester the greatest percentage of student comments were about using study tools they created themselves and discussing study methods that worked well for them.

Table 6.3
Spring 2011 Blog Codes: Study Methods

Theme	Subtheme	1st Half of Semester, n=179	2nd Half of Semester, n=48	Change
Self-Awareness of Learning				
	Success of study methods	7.2	18.8	Almost 3x Increase
	Unsuccessful study methods	0.0	12.5	12x Increase
	New Study Method	13.4	2.1	Over 6x Decrease
Study Tools				
	Laboratory tools	5.0	14.6	Almost 3x Increase
	Student prepared tools	3.9	18.8	Over 4x Increase
	Lecture/textbook tools	26.3	10.4	2.5x Decrease
Study Methods				
	chunking/grouping	1.1	8.3	8x Increase
	Group work	12.3	2.1	6x Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Two of the blogs from the spring 2011 semester were addressing time management, and the results of coding these blogs are shown in Table 6.4. In the first half of the semester (week 3 blog entry) over one third of these comments were general statements about time management. In these statements students discussed very general issues with their studying, like needing to study more or study harder, but the statements lacked any concrete plans for what studying more or studying harder meant. In comparison, just under one third of coded comments were more specific statements about effectively using their time. One such comment was "I want to set aside at least 1 hour each day leading up to the exam to study the lecture material. Then, an additional half hour for the lab material." Instead of specifying specific amounts of time to study some

students planned their studying around their methods for studying. For example, one student said, "my plan is to work through 2 learning matrix sheets and at least 2 sections of the review sheet a day." In the second half of the semester over half of the coded statements were unspecific comments about time management, while more specific comments about time management decreased. There were other changes between the two halves of the semester, but each make up less than 10 percent of coded comments.

Table 6.4
Spring 2011 Blog Codes: Discussing Time Management

Theme	Subtheme	Week 3, n=43	Week 10, n=51	Change
Self-Awareness of Learning				
	Lab & Lecture Overlap	7	0.0	Decrease
Distractions from Learning				
	People	4.7	5.9	Increase
	Location while studying	0	9.8	Increase
Time Management				
	Effective time management	27.9	23.5	Decrease
	Unspecific time management	37.2	54.9	Increase
Study Tools				
	Student prepared tools	9.3	0.0	Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Students were only asked once (post exam 3) to discuss their exam results in their blogs, and the coding results for their self-efficacy are shown in Table 6.5. The greatest percentage of student comments were about their effort matching their exam grade. As one student said, "I have put a lot of effort into studying for the exams and I spend a lot of time weeks before the exams preparing, so I think my grades reflect my hard work."

This is positive, as it is hoped that by the second half of the semester the students would be more efficient in their studying and more effective assessors of their studying. This would also result in students' expectations for exam results being more accurate. The next most common statements were about feeling confident in their preparation but their exam grade was lower than they expected it to be or had hoped it would be. One student stated, "I studied really hard for the lecture exam ad thought I had done pretty well. My grade was not really that low I just thought I would have done a lot better." The third Anat A215 exam is possibly the most challenging exam, which could explain why nearly 16 percent of coded statements were about feeling confident but earning a lower than expected exam grade.

Table 6.5
Spring 2011Blog Codes: Exam 3 Reflection

Theme	**Subtheme**	**Post-Exam 3 n=51**
Self-Efficacy		
	Confident and performs well	9.8
	Confident and performs poorly	15.7
	Not confident and performs well	7.8
	Effort=Grade	23.5

Fall 2011

In the fall 2011 semester, there were more blog entries that provided useful results for assessment. The blog topics were again grouped into three general topics for analysis: assessment of study methods, time management/planning, and exam reflection. Table 6.6 lists the blog topics in chronological order for this semester.

Table 6.6
Fall 2011 Blog Topics

Blog Topic Groupings: Assessing Study Methods, Planning/Time Management, Exam Reflection

Blog Number	Summary of Blog Topic
1	Why enrolled in MSCI M100?
2	How studied previously (high school or college) and how effective?
3	How do you know when you've learned a topic?
4	Exam 1 reflection
5	Plan of attack for exam 2 material
6	Distractions: discuss main distractions and how deal with them?
7	Mid-term evaluation of MSCI M100
8	Exam 2 reflection Plan for exam 3
9	Described most challenging topics in Anat A215 (instructor used these blogs to shape upcoming class activities)
10	How learning exam 3 material
11	Plan of action for last exam
12	Have you stuck with plan? Why/why not?

Table 6.7 shows the results for the three blogs in which students assessed their study methods. During the first half of the semester (blog entry numbers 2 and 3), students felt that their study methods were effective, but they still proposed changes to those methods. As students got further into Anat A215 material they sometimes found that while they are able to learn with their current methods, sometimes they needed to explore other options to learn even better. The following is an example of such a discussion in a fall 2011 student's blog, "I need to be able to understand and grasp concepts on a deeper level rather than just a broad overview of it."

In the second half of the semester (blog entry number 10), students seemed to feel that their methods were working, but similar to the spring 2011 semester, there was an increase in the percentage of statements about not feeling confident about how to prepare for Anat A215 exams. Again, this could be the result of increased metacognitive

awareness, as well as the increasing difficulty of Anat A215 exam material. The methods students had been using may have worked initially, but as the difficulty of the course increased, their study methods may not have been as effective. In the second half of the semester students also favored the use of lecture-related study tools, followed by study tools they created themselves. There was little mention of lab-related study tools early in the semester and no mention of them late in the semester. Students often expressed greater concern about the lecture exams, so it is possible that in their blogs they emphasize studying for lecture and omit discussion of lab.

Table 6.7
Fall 2011 Blog Codes: Assessing Study Methods

Theme	Subtheme	1st Half of Semester, n=226	2nd Half of Semester, n=63	Change
Self-Awareness of Learning				
	Learning Style	5.2	3.2	Decrease
	Success of study methods	27.7	25.4	Decrease
	Unsuccessful study methods	7.4	1.6	Almost 5x Decrease
	New Study Method	12.6	0	Over 12x Decrease
	Not confident about how to prepare	2.2	14.3	Increase
Study Tools				
	Student prepared tools	10.4	12.7	Increase
	Lecture/textbook tools	11.3	22.2	2x Increase
Study Methods				
	Group work	5.6	3.2	Decrease
	Memorization	5.6	1.6	3.5x Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Time management coding results are shown in Table 6.8. The first half of the semester time management blog entries were entry numbers 4, 5 and 6; while the time management entries from the second half of the semester were entry numbers 8, 11 and 12. In these posts students were either proposing a plan of action or discussing how well

they stuck to their plans for studying. In the first half of the semester, students discussed a wider range of topics such as proposing changes to their habits, feeling confident or not confident about how to prepare, and distractions from learning. Communication with other people (either face to face or via technology) and a heavy courseload were the primary distractions from learning anatomy throughout the semester. Later in the semester students became much more explicit in their plan, and apparently were better able to follow through with their plans later in the semester. Nearly 1/3 (31.5% to be exact) of the blog comments were detailing effective use of time, and many more still discussed general planning. The following statements are examples of general discussions of time management by Fall 2011 students:

- "I plan to study smarter, not harder/longer."
- "I don't think I studied enough and I believe I could benefit highly from more time put into my studying."
- "I just need to be sure to manage my time well and keep focused and keep my priorities straight."

In each of these statements the students seem to recognize that they need to make improvements to their time management strategies, but none of these statements describe what it means for them to study more or manage their time well.

Table 6.8
Fall 2011 Blog Codes: Discussing Planning & Time Management

Theme	Subtheme	1st Half of Semester n=210	2nd Half of Semester n=127	Change
Self-Awareness of Learning				
	Success of study methods	2.4	7.1	Almost 3x Increase
	New Study Method	9.5	.8	Almost 12x Decrease
	Confident about how to prepare	6.7	4.7	Decrease
	Not confident about how to prepare	5.2	1.6	3x Decrease
	Lab & Lecture Overlap	6.7	1.6	Decrease
Distractions from Learning				
	People	15.2	7.9	2x Decrease
	Courseload	9.5	5.5	Almost 2x Decrease
Time Management				
	Effective time management	4.8	31.5	Over 7x Increase
	Unspecific time management	10	15.7	Increase
	Ineffective time management	1.4	5.5	3x Increase
Study Tools				
	Student prepared tools	5.2	1.6	3x Decrease
	Lecture/textbook tools	5.2	2.4	2x Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Lastly, students were asked to reflect upon their exam performance on the first and second Anat A215 exams; the results of which are available in Table 6.9. This differs from the spring 2011 semester, in which students completed one exam reflection for the third Anat A215 exam. It was important to the MSCI M100 instructors to include at least two exam reflections. In the fall 2011 blog entries students discussed how effective they felt their methods had been, and whether their performance matched their expectations after the first and second Anat A215 exams. There was an observed increase in the percentage of statements about study methods being successful, with a

decrease in statements about study methods being unsuccessful. More students seemed to be confident prior to the exam and then perform well on exams, and there was a slight increase in the percentage of students feeling confident prior to the exam but not performing as well as expected. One student stated, "As for lecture, I thought I blew it out of the water. I was confident, thought it went so much better than lab, definitely A or B material and got a C-. I couldn't believe it." The second Anat A215 exam is more challenging, and it is possible students prepared the same as they did for the first exam, without accounting for the increased difficulty of this exam material.

Table 6.9
Fall 2011 Blog Codes: Exam Reflection

Theme	Subtheme	Post-Exam 1 Blog, n=114	Post-Exam 2 Blog, n=97	Change
Self-Awareness of Learning				
	Success of study methods	15.8	19.6	Increase
	New Study Method	7.9	3.1	Over 2x Decrease
Self-Efficacy				
	Confident and performs well	6.1	10.3	Increase
	Confident and performs poorly	14	16.5	Increase
Time Management				
	Effective time management	4.4	6.2	Increase
	Unspecific time management	3.5	16.5	5x Increase
	Ineffective time management	4.4	2.1	2x Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Spring 2012

The coding results for the spring 2012 semester were grouped in the same manner as the spring 2011 and fall 2011 blogs (assessing study methods, time management, and exam reflection). The full list of blog topics are listed in chronological order in Table 6.10.

Table 6.10
Spring 2012 Blog Topics

Blog Topic Groupings: Assessing Study Methods, Planning/Time Management, Exam Reflection

Blog Entry Number	Summary of Blog Topic
1	How studied previously (high school or college) and how effective?
2	How do you know when you've learned a topic?
3	Students provided feedback on a specific in-class activity
4	Exam 1 reflection
5	Plan of action for exam 2 material
6	What is most challenging to learn and how attempting to learn it?
7	Stuck to plan in week 5? Would you make changes to that plan?
8	Plan for spring break and post-spring break?
9	What changes have been made to study habits? How effective have those changes been?
10	Stuck to plan made before spring break? Why/why not?
11	Exam 3 reflection
12	Plan of action for last exam
13	What is most challenging for exam 4 and how trying to learn it?
14	Stuck to plan for last exam?

Blog entry numbers 1, 2 and 6 comprise the first half of the semester results, and blog entry numbers 9 and 13 make up the second half of the semester results. Although students were asked to discuss study methods in these blogs, there was an increase in the percentage of comments about planning and time management in the second half of the semester. This coincided with large decreases in the percentage of comments about specific study methods from the first half of the semester to the second half. Even so, over 20 percent of coded comments were revolving around successful use of study methods in both halves of the semester. It would appear that although there were fewer comments about specific study methods in the second half of the semester, students felt that their methods were effective. One student stated, "I have also found that the matrices are helpful. I feel I have really grown my study skills for the better!"

Table 6.11
Spring 2012 Blog Codes: Assessing Study Methods

Theme	Subtheme	1st half of semester, n=195	2nd half of semester, n=158	Change
Self-Awareness of Learning				
	Success of study methods	22.6	20.3	Decrease
	Unsuccessful study methods	5.1	3.8	Decrease
	Not confident about how to prepare	5.1	1.2	4x Decrease
Time Management				
	Effective time management	6.2	13.9	2x Increase
	Unspecific time management	5.1	8.2	Increase
Study Tools				
	Student prepared tools	7.1	10.8	Increase
	Lecture/textbook tools	6.7	10.8	Increase
Study Methods				
	Group work	7.7	2.5	3x Decrease
	Self-quizzing	12.8	0.0	12x Decrease
	Memorization	6.2	3.8	Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Table 6.9 shows the coding results for planning/time management blogs in the spring 2012. In both halves of the semester (1st half includes blog entry numbers 5, 7, 8, and the 2nd half includes blog entry numbers 10, 12, 14) the greatest percentage of comments were about students effectively using their time. One student made the following realization, "I didn't realize how important it was to study for weeks in advance to get to know the material." The greatest change from the first to the second half of the semester was about discussion of course load (i.e., the total number of credits a student takes per semester) as a distraction from studying. In the second half of the semester there were five times more comments about course load pulling students away from

studying for Anat A215. This lines up with the observed increase in discussion of ineffective time management.

Table 6.12
Spring 2012 Blog Codes: Time Management

Theme	Subtheme	**1st half of semester, n=312**	**2nd half of semester, n=234**	**Change**
Self-Awareness of Learning				
	Success of study methods	10.6	7.7	Decrease
	Confident about how to prepare	2.9	6.4	2x Increase
Distractions from Learning				
	Course load	1.3	6.8	5x Increase
Time Management				
	Effective time management	21.1	24.4	Increase
	Unspecific time management	9.3	14.5	Increase
	Ineffective time management	4.5	11.5	2.5x Increase
Study Tools				
	Student prepared tools	14.4	9.0	Decrease
	Lecture/textbook tools	13.8	3.8	3.5x Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

In the spring 2012 semester there were only two blogs in which students discussed Anat A215 exam results, once after the first exam (blog entry 4) and once after the third exam (blog entry 11). During the fall 2011 semester students reflected upon the first and second anatomy exams. The decision was made to wait until the third exam to complete a second exam reflection. The second and third Anat A215 exams are quite challenging and it is likely that if a student encounters difficulty on the second exam they will make changes to their study habits. Waiting until the third exam allowed not only for students to discuss changes they needed to make, but it allowed students to reflect on the efficacy of those changes.

The coding results for these exam reflection blogs are in Table 6.10. Many students felt their exam scores were not as high as expected/desired, despite feeling confident going into the exam. As stated by one of the spring 2012 students, "I believe after all the work and studying I put into it that I still deserve an A, but this just shows me that I still have some things I need to work on." The percentage of such comments decreased from the first to the third exam. There was an increase in the number of students who were confident and did well. Although these blogs were reflecting upon exams, many comments revolved around planning/time management. After the third Anat A215 exam there was a decrease in the percentage of comments about effective time management, as well as ineffective time management. There was an increase in the percentage of unspecific comments about time management.

Table 6.13
Spring Blog 2012 Codes: Exam Reflection

Theme	Subtheme	**Post Exam 1 Blog, n=93**	**Post Exam 3 Blog, n=98**	**Change**
Self-Awareness of Learning				
	Success of study methods	5.4	4.1	Decrease
	New Study Method	8.6	5.1	Decrease
	Confident about how to prepare	5.4	1	5x Decrease
	Not confident about how to prepare	3.2	6.1	2x Increase
Self-Efficacy				
	Confident and performs well	6.5	8.2	Increase
	Confident and performs poorly	21.5	15.3	Decrease
	Not confident and performs well	1.1	5.1	5x Increase
	Effort=Grade	11.8	11.2	Minimal Change
Time Management				
	Effective time management	7.5	2	Almost 4x Decrease
	Unspecific time management	8.6	16.3	Almost 2x Increase
	Ineffective time management	10.8	9.2	Decrease

*Subthemes which comprised fewer than 5% of coded comments in either ½ of the semester were not included in the table.

Overall Blog Trends

Over the course of each semester, students expressed many of the same concerns and had many of the same realizations about their study habits. One such realization about studying for exams was very similar to this fall 2011 student's insight, "I didn't realize how important it was to study for weeks in advance to get to know the material." Many students had to make changes to their study habits in order to be successful on Anat A215 exams. Blogs often contained comments about specific study methods that were effective for learning. For example, one spring 2011 student stated, "I have also found that the matrices are helpful. I feel I have really grown my study skills for the better!" Other students found that their attitude and overarching approach to learning

made a difference in their success. Instead of simply memorizing information they needed to develop a deeper understanding of the material. Many students made comments similar to this statement by a student from the spring 2012 semester, “I had convinced myself that I remembered this material fairly well when I really hadn't.” A student from the fall 2011 semester said, “Now, I make sure that I not only memorize the information, but that I actually understand what I am studying.” Such statements demonstrate awareness of students that they needed to make changes to see the results they desired in Anat A215. In order for students to make improvements to their methods, they must first recognize their current deficits. It seemed that in all three semesters students were able to do this, propose changes to their methods and assess how well those changes worked for them. Also consistent across semesters was the feeling among many students that they were prepared for exams, yet their grade did not reflect their preparation. One student said, “As for lecture, I thought I blew it out of the water. I was confident, thought it went so much better than lab, definitely A or B material and got a C-. I couldn't believe it.” This demonstrates a gap in this student’s metacognitive awareness of how well they knew the material being tested, but recognition of such a gap allows students the opportunity to fix the problem. Another student expressed a similar sentiment, but also stated “…this just shows me that I still have some things I need to work on.” This willingness to admit that they need to adjust is crucial for students to actually improve their skills.

Discussion

The blogs gave the students insight into many areas of their learning. Reflective writing has been an effective method for promoting metacognition in nursing students (Fonteyn & Cahill, 1998). After reviewing 30 reflective diaries of second year nursing students, Richardson and Maltby (1995) suggested that all students may benefit from written reflection, as it assists students in developing learning skills. In addition, the blogs were also a useful tool for MSCI M100 instructors to shape the course, as well as the way they attempted to address various topics within the blogs. Throughout the process of coding the blogs it seemed as though the students' responses with each progressing semester became more and more insightful into their learning. In the spring 2011 the blogs were utilized to cover a much broader range of topics, allowing for fewer comparisons within the semester. Also, student comments were more general in nature, making it difficult to specify whether or not there was much change throughout the semester.

In the fall 2011 and spring 2012 semesters, students seemed to be more explicit about various aspects of their learning process. This improved clarity of students' blogs can be explained, at least in part, by improvements in the prompts given by the instructor. Each time the course was taught the instructor(s) became more explicit with the directions for each week's blog posting, better prompting students to deeply reflect on their learning process.

The blogs in which students addressed the effectiveness of their study methods there was a shift in fall 2011 and spring 2012 semesters. In the first half of these semesters a greater percentage of student comments were assessing the effectiveness of

their study methods, and they addressed specific methods they used (e.g., self-quizzing, chunking, etc.). In the second half of these semesters their statements shifted from discussion of which methods or tools they were using to how well those methods and/or tools were working for them. It is possible that students become more aware of their learning process and were better able to recognize study methods that were more effective for them, resulting in greater discussion of the usefulness of their methods. There was also an observed increase in the percentage of comments stating the student felt confident in their study methods and overall preparedness for exams. High levels of self-efficacy and effective monitoring of the learning process are linked to academic success (Garrett et al., 2007; Lindner & Harris, 1992; Zimmerman & Martinez-Pons, 1990). Future analysis of MSCI M100 could include examination of individuals' blogs throughout the semester and their grades in Anat A215 would provide even more detailed insight into improvements in metacognition, and potentially support past findings that metacognition and academic success are linked.

In all semesters analyzed, many students reported feeling confident in their preparation for an exam, but their exam grade was lower than they expected or desired. This suggests there is a deficit in several students' abilities to effectively monitor their learning. This is consistent with finding by Naug and colleagues (2011), who showed through an in class activity that the majority of first year university students in an anatomy and physiology perceive that their knowledge to be greater than it is in actuality. As previously mentioned, the majority of Anat A215 and MSCI M100 students are in their first or second year of college. It is possible that the methods employed by these students in high school resulted in academic success, leading students to be overly

confident of their original study methods. In contrast, college is much more challenging than high school, but some students initially fail to recognize the discrepancy in difficulty. Approaching college courses with the same methods used in high school initially leads students to feel confident, but these methods do not lead them to the same degree of success. A student from the fall 2011 semester said, "I struggled last year because I thought I could cram everything in last minute and be fine. But I learned the hard way that it doesn't work like that." Sometimes the issue isn't a lack of effective study skills, but an overall lack of skills in general. Another student in the fall 2011 semester stated, "In high school I never had to study so I don't really know how too." Students seemed to recognize the need to study in college, but they struggled with how to best prepare.

Another struggle for students was managing their time. Improving time management became a greater focus within each semester of MSCI M100, partly due to students expressing concern about it and partly due to its importance in academic success. An analysis of 90 college students' cumulative GPAs, SAT scores and responses on a time management survey revealed time management was a better predictor of academic success than SAT scores (Britton & Tesser, 1991). When discussing study methods or reflecting on exams students were less explicit in their discussion of time management, but when asked to outline a plan students gave more detailed descriptions of how they intended to utilize their time. As the semesters progress students often gave more detailed plans for using their study time, and they also seemed to stick to their plans better. In the fall 2011 and spring 2012 semesters students discussed time management more as the semester progressed, but prior to the final exams in Anat A215 their

discussion became more general in nature. This may be linked to the pattern found in the study logs discussed in the previous chapter, in which students were spending a greater portion of time being less productive. It is possible that fatigue and the amount of work to be done at the end of the semester leads students to be less focused and less productive use of time.

While the blogs have been a useful tool, there are limitations to this analysis. To pull more explicit and more useful data from the blogs, there are a few adjustments which could be made. Giving the same prompts multiple times within a semester would better allow for comparisons within that semester. Then, using the same blog prompts in subsequent semesters would make comparisons between semesters stronger. The codebook used to analyze the blogs provided for a general overview of many issues discussed in the blogs. However, a more specific codebook pertaining to specific topics (e.g., study methods used, metacognitive statements, etc.) would potentially generate more extensive results pertaining to these topics.

Reflective writing via the blogs seems to help prompt student reflection. This can be utilized by instructors to improve metacognition and hopefully, in turn, help students be successful academically. Additionally, student reflections can be used by instructors to better shape pedagogy in a course like MSCI M100 or in a regular basic sciences course. The results of the blogs analysis will be tied in with the findings from other analyses discussed throughout this dissertation in Chapter 7. These results have implications for students and instructors of anatomy and other science courses. There are also implications for curriculum developers and academic advisors. All of these

implications, as well as limitations and directions for future research will be discussed in the next chapter.

Chapter 7: Conclusions

The research described in this dissertation has implications for anatomy students and instructors, as well as academic advisors at IU and other institutions. In this chapter the implications based on the analysis of remediation trends in Anat A215 and the outcomes of assessing MSCI M100 are discussed. Next is a discussion of the theoretical implications drawn from this research, and I continue with the limitations of this research and directions for future research.

Remediation in Anat A215: Conclusions & Implications

Several trends associated with remediation were noted in the analysis of Anat A215 data. Analysis of the demographic data revealed females, pre-nursing majors and University Division (UD) students are more likely to remediate than their classmates. These findings are not surprising, as most of the pre-nursing students are also female and enrolled in UD. These students are taking Anat A215 as a prerequisite for nursing school, and in order for them to be competitive applicants, they typically need to earn an A or a high B in anatomy. If the necessary grade is not earned during their first enrollment, even if it is a "good" grade by most standards, these students enroll a second time. Thus, a substantial number of Anat A215 remediators are not in academic trouble like traditional remediators may be.

In general, remediating anatomy students performed significantly better during their second enrollment. During the second Anat A215 enrollment, students who remained enrolled in the course for the entire duration of their first enrollment outperformed students who withdrew during their first enrollment. Additionally, students who waited to re-enroll in Anat A215 until 3-4 terms after the initial enrollment

outperformed students who re-enrolled sooner. It is possible that during the several semesters between enrollments these students were able to develop more both their study skills and overall awareness of how they learn. It is also possible that these students have matured and are more committed to their studies. It appears that if a student will need to remediate Anat A215 it would be more beneficial for the student to remain enrolled in the course (and not withdraw initially) as well as wait 3-4 terms to repeat the course. This recommendation is ideal; however it may not be suited for all students. Discussion of potential conflicts students may encounter with this recommendation are discussed later in this chapter.

Implications for Anatomy Instruction at IU

From the beginning of the semester, anatomy instructors have access to students' majors of study, as well as their official class ranking (freshmen, sophomore, etc.). This information can help instructors determine who may be at a greater risk of struggling in the course (e.g., freshmen, females, pre-nursing students). These students do not need to be singled out immediately, but it would be beneficial for instructors to pay attention to how these higher risk students are progressing in the course. The first lecture and laboratory examinations given in Anat A215 seem to set the tone for the semester for most students. If a student performs poorly on these first exams, they tend to not do well on following exams. After the first set of exams, it is important for instructors to attempt to intervene with the students who did not perform well. In the very minimum, instructors can discuss exam results with students and prompt students to think about which study methods were effective and which methods were less effective. This can lead into a discussion about available resources (which could include online resources,

tutors, etc.), changes the student could make and new methods to try. This may require an instructor to demonstrate a new method and help a student try it for the first time.

Also, even if a student continues to struggle in the course, those students who completed the entire semester during their initial enrollment were more successful when they remediated than students who withdrew during the first enrollment. If it is feasible for the student to remain in Anat A215, it is to their benefit to complete the entire semester. When enrolling for the second time it would also benefit students to wait a few semesters. For example, if a student took the course in the fall semester, enrolling for a second time the following fall would be ideal. Instructors should be aware of these trends so that they can advise students accordingly. It is also important for instructors to be aware of the student's situation. While remaining enrolled in the course may be the most beneficial in terms of learning anatomy, in some instances it may be better for the student to withdraw. For example, earning a final grade of an F in a 5 credit-hour course can have serious negative consequences for a student's transcript and/or financial aid situation.

Implications for Academic Advisors

Many students need to take Anat A215 earlier than later in their academic career to fulfill program requirements. Pre-nursing students take anatomy early in their coursework so that they can apply to nursing school at the end of their freshman year. Even so, it would benefit them wait until at least their second semester of college to enroll in the course. This allows students to adjust to college life and develop better study skills so they can succeed in challenging courses like Anat A215. Athletic training students are in a similar situation. Many students will apply to the athletic training

program at IU during the spring of their freshman year. This means many of them take anatomy in their first semester of college coursework. In contrast, students in some programs aren't required to take anatomy until they've been accepted to the program, so they are easily able to take Anat A215 in their second or third year of college. These variable circumstances are important, not only for students to consider, but academic advisors should be aware of this trend and advise students accordingly. Remediating anatomy will likely throw off students' timelines for applying to various academic programs. Waiting until at least the second semester of the first year of college may result in students earning competitive grades during their first Anat A215 enrollment. This saves them the time and money associated with repeating the class, and it opens up spots for other students to enroll in the course.

MSCI M100 Analysis: Conclusions & Implications

The various analyses of MSCI M100 revealed a positive impact on students. The study logs, surveys and blogs all showed positive trends associated with improved time management, increased comfort with managing the learning tasks associated with Anat A215 and improved awareness about how best to learn anatomy. The blog analysis also showed an increase in the percentage of comments about feeling confident and performing well on anatomy exams. Although these trends are positive, continued analysis is necessary to determine if the changes are a direct result of participation in MSCI M100.

Success of such a course raises questions about whether or not a course like MSCI M100 should be required for remediating students, or for all students. The supplemental course offered by Hopper (2011) at the University of Southern Indiana (USI) is required

for any student remediating the anatomy and physiology course. Students at USI showed significant improvements in their comfort with many aspects of the learning process, and students who complete the course were successful in their anatomy and physiology course. If courses like this are so successful it would seem reasonable to require it, in the very minimum, for remediating students. Yet, requiring coursework for remediating students could be problematic, as it has to potential for developing a negative stigma (Blanc et al., 1983; Bridgham & Scarborough, 1992; Bronstein, 2008; Etter et al., 2001). Avoiding this stigma is partly why Supplemental Instruction programs are voluntary, and focus on the "at-risk courses" instead of students who are at risk for failing (Arendale, 1997; Blanc & Martin, 1994; Bridgham & Scarborough, 1992; Etter et al., 2001; Sawyer et al., 1996). Such considerations are important for course developers, and it is necessary to weigh the options. By not requiring the course it is likely that some students who would truly benefit from the course will not enroll. Requiring the course will potentially create a negative stigma, which could influence the willingness of students to participate (Arendale, 2002).

Implications for Science Instructors

Many of the conclusions drawn from the assessment of MSCI M100 have implications for science instructors. Instructors often provide students with suggestions for various study methods. We are aware that these methods work, but many students need an extra push to try a method they've never used. For example, if a student has never drawn pictures as a method for studying, the thought of doing so can be rather daunting. As instructors it would benefit our students if we not only provide them with study suggestions but actually show them *how* to perform the study methods we propose.

This is something that could easily be integrated into the teaching of regular course material. In MSCI M100, the instructor would essentially scaffold different study methods, such as developing a flow chart. Applying such an activity to a regular course could be done as a means of teaching or reviewing information. An instructor could start describing a process and begin a flow chart. Then students can work together to complete the chart. The class would then reconvene to discuss with the instructor how the chart should be completed. This provides everyone with a chance to review the material, as well as gain practice with creating a flow chart.

Additionally, the M100 analysis demonstrated that students had some deficits in their awareness of their own study habits. Many students commented that the study logs surprised them because once they were forced to think about their productivity, they were not as productive as they originally thought. Also, each semester's M100 blog analysis showed a fair percentage of comments every semester were about students feeling confident in their preparation for exams, but their grade was lower than they expected. Instructors could incorporate a variety of reflective activities to help raise students' awareness of their own learning. Angelo and Cross (1993) describe several activities that could be implemented, including a focused autobiographical sketch in which students write a couple paragraphs about a successful past learning experience that is relevant to the current course. Another method suggested is a muddiest point exercise in which students write down whatever topic is most confusing from a lecture, discussion, etc. This provides the instructor with feedback about what students find confusing and also helps students identify what they do not understand (Angelo & Cross, 1993). Reflection on learning is a powerful tool for improving metacognition, and completing such

reflections could help raise students' awareness of their learning process in their science courses (Chen et al., 2005; Schraw, 1998). This could also be advantageous for instructors because being aware of issues students may be experiencing can help instructors tailor their pedagogy.

Theoretical Implications

The results of this study have shown that many undergraduate anatomy students experience imbalances within their metacognitive awareness. One such imbalance is when students believe that they are well prepared and have learned the material for an upcoming exam, yet their exam grade suggests they did not adequately learn the material. These students struggle to recognize that there is a deficit in their own preparation. The other imbalance observed was with students who recognize there is a problem in their approach to learning. These students know they need to make changes to their learning process, but some are unaware of how to do so, seemingly due to a lack of knowledge about different methods which could be implemented. The limiting factor for these students seems to be their narrow skill set that pertains to learning. Other students appear to lack motivation to put in the necessary effort or make changes to their current habits, which also makes it difficult for students to achieve higher grades (Wolters, 1998). An MSCI M100 student in the spring 2012 semester said, "I cannot find the time or motivation to balance all of my subjects." Contrasting this comment, some students recognize that motivation is necessary to succeed. An MSCI M100 fall 2011 student was discussing what they felt was necessary to do well in Anat A215 and stated, "motivation and believing that you can ace the tests or to understand the material then it is possible to do well."

To aid students experiencing either version of disequilibrium in their learning, instructors can begin by helping students to improve their mindfulness of their learning (boost metacognitive awareness). As seen in this research, until students were forced to reflect on their learning process, many are not fully aware of their own potential pitfalls. Incorporation of reflective writing, even in a science course, could be a very useful tool for instructors to raise the metacognitive awareness of their students. Additionally, as students become more aware of how they learn best, it is necessary to help them expand upon their current skills associated with learning. Students are often comfortable with methods that are ineffective for adequately learning in the undergraduate environment. Providing students with opportunities to practice with new methods for learning information can help students to expand their repertoire. Doing so helps students to better be able to adjust their approach to learning if they've assessed their current methods to be ineffective.

Additionally, the results shown here are important to be considered by those involved in curriculum development for nursing and pre-allied health programs at IU and elsewhere. Anatomy is a challenging course, and students enrolling in this course during the first year of college are struggling through it. Anatomy is one of the foundational courses for health programs, so it is imperative that students gain a solid understanding of the material being covered. Based on the research presented in this dissertation and previous studies, many students entering college seem to lack the appropriate levels of metacognitive awareness and/or adequate study skills to be successful in anatomy during their first year of undergraduate studies (Garrett et al., 2007; Lindner & Harris, 1992; Naug et al., 2011). Students who waited until their second or third year of college were

more successful during their first enrollment. If a nursing or pre-allied health program's requirements (either for admission or completion of the program) require anatomy, it is worth considering when students take their anatomy class. Based on the current study, students would likely be more successful if they enroll in anatomy after, at least, the first year of college.

Limitations

There are some limitations of this research. While over six years of data was analyzed, it is possible that there are students included in the data set who were classified as non-remediators, when in fact they were remediators, but the data showing this was not collected. For example, some students who first enrolled in Anat A215 prior to the spring 2004 semester would not be classified as a remediator, because the time span analyzed only shows the second time they took the class. Likewise, this time span would not capture data where a student enrolls a second time in A215 after the spring 2010 semester. Additionally, there is potentially some variance in this data due to instructors. There are three different lecturers for the course, and many associate instructors who lead labs. The course material is essentially the same each semester, but the pedagogical methods employed by each instructor vary.

When considering the MSCI M100 analyses there are also limitations. First is that the sample sizes are limited (n ranged from 27 to 41). While a sample size of 41 is sufficient for a number of statistical analysis, such analyses would be strengthened by larger samples. As the course continues to be offered there is potential for enrollment to increase, allowing for larger sample sizes. Even so, enrollment will be limited to allow for quality instruction. In order to effectively teach students how to study it is preferred

to have a more intimate setting, allowing the instructor to make connections with the students. Doing so also requires a smaller class size, and therefore smaller sample sizes.

Also, as each semester of MSCI M100 was taught there were adjustments made to the course assignments and the number of instructors (from two to one). Two instructors provided multiple perspectives and approaches, which may have been more beneficial for some students. Still, team-teaching requires a great deal of communication and organization between instructors themselves, as well as between instructors and students. With only one instructor there is more consistency. As the instructor gained experience teaching MSCI M100, it is likely that her effectiveness as an instructor improved. Lastly, the surveys, study logs and blogs are all self-reported measures from the students. It is assumed that students are honest in their reporting, but it is a limitation to consider when interpreting results. It is possible that when answering survey questions some students did not fully understand the questions being asked, and it is possible that when students responded to the surveys, study logs and blogs that their memory and/or estimation strategies were flawed when responding (Groves et al., 2009).

Directions for Future Research

Remediation in Anatomy A215

Delving deeper into the issues behind who remediates anatomy and why they need remediation is a possible route for future research. The analysis in this research was limited to basic demographic information, but as previously discussed, there are numerous factors associated with remediation. Developing a study which captures other influences on student academic performance in Anat A215, such as metacognition, could allow for an even better understanding of who requires remediation of Anat A215 and

how instructors can help students succeed in their initial enrollment. It could also be tied into the future research of MSCI M100.

Study Skills in Anatomy

One of the MSCI M100 course goals is to improve student metacognition as it applies to Anat A215, as well as their other coursework. A longitudinal study design to better measure changes in student metacognition over the course of their enrollment in all undergraduate courses would be useful to more thoroughly assess if this goal is being met. In such a study a control group of students enrolled in Anat A215 but not in MSCI M100 would all for examination of metacognitive trends of students not enrolled in MSCI M100. This could be conducted through the use of a survey, or these students could complete a specified number of blogs (reflective writing of some sort). The results from this could be compared between Anat A215 students who are and students who are not enrolled in MSCI M100.

The survey results and shifts in metacognition observed in the blogs are promising, but a proper control would allow for comparison. It would help to rule out whether or not the observed changes are a result of enrollment in MSCI M100, or if it is simply due to increasing comfort levels with how to prepare for Anat A215 as the semester proceeds. Also, as MSCI M100 continues to be taught by other instructors, there is the potential that enrollment will increase, therefore increasing sample size and strengthening statistical analysis.

Another direction for research involves development of a more specific codebook(s) to more thoroughly assess students' blogs for changes in self-efficacy and other issues related to metacognition. To allow for stronger comparisons the blogs

should also be standardized, so that each semester of MSCI M100 students are responding to the same prompts. Additionally, while assessing aggregate trends in the blogs can be useful, analyzing trends within an individual student's blogs and grades in Anat A215 would provide a better understanding of how individual student metacognitive awareness changes throughout the semester. It would also be an opportunity to assess possible relationships between such changes and performance in Anat A215.

Appendix A: Demographic Characteristics of Anat A215 Students

Demographic Characteristic		All Anat A215 Students n=4622		Remediators n=511		Non-Remediators n=4111	
		n	%	n	%	n	%
Gender	F	3471	75.1	408	79.8	3063	74.5
	M	1151	24.9	103	20.2	1048	25.5
Ethnicity	American Indian/Alaska Native	15	0.3	3	0.6	12	0.3
	Asian	188	4.1	24	4.7	164	4
	Black	246	5.3	53	10.4	193	4.7
	Hispanic/Latino	106	2.3	9	1.8	97	2.4
	Native Hawaiian/Other Pacific Islander	1	0	0	0	1	0
	Not Applicable (Alien)	79	1.7	6	1.2	73	1.8
	White	3987	86.3	416	81.4	3571	86.9
School	BUS	19	0.4	0	0	19	0.5
	COLL	1084	23.5	50	9.8	1034	25.2
	EDUC	15	0.3	2	0.4	13	0.3
	HPER	1352	29.3	150	29.4	1202	29.2
	INFO	7	0.2	0	0	7	0.2
	JOUR	8	0.2	0	0	8	0.2
	MUS	15	0.3	0	0	15	0.4
	NURS	15	0.3	3	0.6	12	0.3
	SCS	111	2.4	4	0.8	107	2.6
	SPEA	9	0.2	0	0	9	0.2
	UDIV	1987	43	302	59.1	1685	41
Majors	HPER: Non-ExSci/AthTrng/Diet/Nutr	158	3.4	17	3.3	141	3.4
	Athletic Training	184	4	21	4.1	163	4
	Dental Hygiene	78	1.7	13	2.5	65	1.6
	Dietetics	193	4.2	16	3.1	177	4.3
	Exercise Science	909	19.7	108	21.1	801	19.5
	Biology	638	13.8	37	7.2	601	14.6
	Exploratory Baccalaureate	131	2.8	12	2.3	119	2.9
	Fitness Specialist BSK	55	1.2	4	0.8	51	1.2
	General Studies	64	1.4	4	0.8	60	1.5
	Chemistry/Biochemistry	171	3.7	4	0.8	167	4.1
	Non-Degree SCS Ugrd	50	1.1	0	0	50	1.2

	Other Math/Science/Neuro /Info	36	0.8	1	0.2	35	0.9
	Nutrition Science	127	2.7	12	2.3	115	2.8
	Public Health	115	2.5	24	4.7	91	2.2
	Music/Dance/Fine Arts	38	0.8	0	0	38	0.9
	Psychology	170	3.7	10	2	160	3.9
	Business/SPEA	37	0.8	1	0.2	36	0.9
	Education	50	1.1	4	0.8	46	1.1
	Pre-Allied Health	50	1.1	4	0.8	46	1.1
	College: NonScience/Math	163	3.5	9	1.8	154	3.7
	Other	10	0.2	0	0	10	0.2
	Human Development/Family Studies	38	0.8	4	0.8	34	0.8
	Nursing	1046	22.6	190	37.2	856	20.8
	Pre Radiation Therapy	40	0.9	5	1	35	0.9
	Pre Radiography	54	1.2	10	2	44	1.1
	SPHS	17	0.4	1	0.2	16	0.4

Appendix B: Anat A215 Exam Comparisons: Students who Withdrew versus Students who Earned a Grade in First Anat A215 Enrollment

1st enrollment

Exam	t	Significance (p)
Lab 1	9.05	.000
Lecture 1	7.54	.000
Lab 2	7.53	.000
Lecture 2	6.33	.000
Lab 3	31.81	.000
Lecture 3	9.13	.000
Lab 4	59.12	.000
Lecture 4	55.21	.000

2nd Enrollment

Exam	t	Significance (p)
Lab 1	4.692	.000
Lecture 1	3.210	.010
Lab 2	4.41	.000
Lecture 2	1.61	.110
Lab 3	7.25	.000
Lecture 3	3.64	.000
Lab 4	4.60	.000
Lecture 4	2.44	.016

Appendix C: Independent T-test Results: Exam Comparisons Between Remediators' Term-Enrollment Differences in Anat A215

1st Anat A215 Enrollment

Term Enrollment Difference	Exam	Mean Score	Significance (*=p<.05, **=p<.00)
1 vs. 3	Lab 1	60.10 67.31	**
	Lecture 1	61.58 68.01	**
	Lab 2	61.39 66.78	*
	Lab 3	54.31 61.56	*
	Lab 4	56.87 67.29	**
	Lecture 4	54.70 62.39	*
	Total Course Points	362.61 432.35	**
1 vs. 4	Lab 1	60.10 67.95	*
	Lab 2	61.39 75.71	**
	Lecture 2	55.54 62.86	*
	Lab 3	54.31 70.65	**
	Lecture 3	54.76 69.68	**
	Lab 4	56.87 73.46	**
	Lecture 4	54.70 70.08	**
	Total Course Points	362.61 506.96	**
2 vs. 3	Lab 2	61.27 66.78	*
	Lecture 3	53.94 59.25	*
	Lab 4	59.40 67.29	*
	Lecture 4	51.71 62.39	**
	Total Course	387.30	*

	Points	432.35	
2 vs. 4	Lab 2	61.27 75.71	**
	Lab 3	58.00 70.65	**
	Lecture 3	53.95 69.68	**
	Lab 4	59.40 73.46	**
	Lecture 4	51.71 70.08	**
	Total Course Points	387.30 506.96	**

Second Enrollment in Anat A215

Term Enrollment Difference	**Exam**	**Mean Score**	**Significance** (*=p <.05, **=p<.00)
1 vs. 2	Lecture 1	77.12 71.40	**
	Lecture 2	70.30 64.32	**
	Total Course Points	584.24 531.84	**
1 vs. 3	Lab 3	71.33 77.15	**
	Lecture 3	65.50 72.99	**
	Lecture 4	70.63 77.48	**
1 vs. 4	Lab 1	84.76 89.18	**
	Lecture 1	77.12 84.27	**
	Lab 2	79.47 87.71	**
	Lecture 2	70.30 78.13	*
	Lab 3	71.33 81.91	**
	Lecture 3	65.50 77.93	**
	Lab 4	77.35 85.36	**
	Lecture 4	70.63 80.18	**

	Total Course Points	584.24 650.91	**
2 vs. 3	Lecture 1	71.40 78.75	**
	Lab 2	78.93 82.48	*
	Lecture 2	64.32 72.34	**
	Lecture 3	65.65 72.99	**
	Lecture 4	72.74 77.48	*
	Total Course Points	531.84 593.77	**
2 vs. 4	Lab 1	83.72 89.18	*
	Lecture 1	71.40 84.27	**
	Lab 2	78.92 87.71	**
	Lecture 2	64.32 78.13	**
	Lab 3	74.34 81.91	**
	Lecture 3	65.65 77.93	**
	Lab 4	77.91 85.36	*
	Lecture 4	72.74 80.18	*
	Total Course Points	531.84 650.91	**

Appendix D: 2010 Summer II Session Syllabus for MSCI M100

Improving Learning Skills in Anatomy (MSCI M100)

Location: Jordan Hall 009

Instructors: J. Smith
Audra Schutte

Required Texts:

Human Anatomy, Michael McKinley and Valerie Dean O'Loughlin, 2nd Edition, 2008

Course Description:
This course examines metacognitive skills that can improve students' learning in A215: Basic Human Anatomy. A variety of study methods and skills will be explored to increase understanding of topics in human anatomy while topics are being covered in A215. Class will meet twice weekly during the summer session.

Pre-requisites:
Students enrolled in M101 must be concurrently enrolled in A215: Basic Human Anatomy.

Learning Goals
A student who successfully completely M100 should achieve the following learning goals:

1. Recognize and implement metacognitive skills
2. Explain and differentiate most major body systems
3. Implement anatomical knowledge in clinical situations

Goal	Core Competency	Assesment
• Recognize different ways you learn effectively and introduce these into your studies	• Effectively analyze your exam performance • Utilize multiple study methods • Recognize which methods are best for you	• Journal writings • Survey about study habits • A215 Laboratory exam analysis
• Explain and differentiate most major body systems	• Compare and contrast the functions of each body system • Describe how	• pre lecture quizzes, final grade

	these major body systems interact with one another	
• Implement anatomical knowledge in clinical situations	• Connecting various symptoms and pathologies to the the body systems affected	• Problem based learning exercises • Pre-lecture Quizzes

Course Assessments
Students will be assessed in the following ways:

1. **Journal Writings (5pts)-** These journal entries will be student's evaluation of their own study strategies. Before each class meeting, you will record what you feel is a topic(s) you do not understand and how you have been trying to learn that topic. Also record what learning techniques you have been using to learn that day's material. Evaluate how effective that learning technique has been for you to learn the material – was it successful? Do you feel like there are drawbacks with the method? These will be due by 8pm on Tuesday and Sunday evenings, and will not be due on days prior to exams.
2. **Problem Based Learning Exercises (PBL) (40pts total)-** You will be given a write-up about a patient that comes to your "office" and presents with a range of symptoms. It will be up to you to determine a list of differential diagnoses (e.g., a list of all of the reasonable possibilities as to what may be wrong with the patient). This will be possible with the body systems information from A215 and the pre-lecture readings.
3. **Pre-Lecture Quizzes (5pts each) -** These online quizzes will be opened after the previous lecture is ended. Lecture quizzes will be based on readings for the next class' material. Each quiz will be five questions long and will be due by 8 pm on Tuesday and Sunday evenings along with the journal writings.
4. **Lab-Exam Analysis-** After each lab exam, in place of a pre-lecture quiz, you will complete a journal assignment analyzing which exam questions you missed and why, as well as what concepts from class you found useful in studying for the exam. In class we will go over your lab exams, answer any questions and assess the metacognitive issues that came up during preparation for the exam.
5. **Study Exercises-** Throughout the course of the semester various worksheets, and assigned questions will be provided in order to provide different options for studying the material that you may not have used before.
6. **Final Project-** This will be a case study, which will be provided in parts over multiple weeks. It will encourage you to connect the body systems that you have studied in gross with what was learned in lecture, and some additional medical knowledge which will be provided for you.

M100 Points Distribution

Assessment	Points
Journal writings	70
Problem Based Learning Exercises	30
Pre-Lecture Quizzes	70
Study Exercises	150
Final Project	30
Total Course Points	**350**

The grade distribution will be as follows:

A- 315
B- 280
C- 245
D- 210

WITHDRAWALS AND INCOMPLETES

We will adhere to University policies. Under Indiana University policies:

- A grade of Incomplete (I) may be given only when the work of the course is substantially completed and when the student=s work is of passing quality@ (*Indiana University Bulletin, College of Arts & Sciences*). If a student is given an incomplete, the existing exam grades remain "on the books" for the student and the student may make up only that material that he/she had to miss.
- If your dean permits you to withdraw after the date for an automatic W, the course director will give you a W (if your grade is D- or better) or an F (if your grade at that point is an F).

ACADEMIC MISCONDUCT

This includes, of course, cheating: "A student must not use or attempt to use unauthorized assistance, materials, information, or study aids in any academic exercise..." It also includes interference: "A student must not steal, change, destroy, or impede another student's work" *(Code of Student Rights, Responsibilities and Conduct.)* Therefore, do not remove or damage any of the materials in the laboratory. We adhere to the University's guidelines for penalties and procedures (e.g. notifying the Dean of Students).

Appendix E: Spring 2012 MSCI M100 Syllabus

Improving Learning Skills in Anatomy (MSCI M100)

Instructor: Audra Schutte
afschutt@umail.iu.edu
Office: Jordan Hall, Room 009A
Office Hours: By appointment

Location: Ballantine Hall, Room 344
Fridays, 10:10a.m. – 11:00a.m.

Required Texts:

Human Anatomy, Michael McKinley and Valerie Dean O'Loughlin, 2nd Edition, 2008

Course Description:

This course examines metacognitive skills that can improve students' learning in A215: Basic Human Anatomy. A variety of study methods and skills will be explored to increase understanding of topics in human anatomy while the same topics are being covered in A215. Class will meet once each week during the 2012 spring semester.

Pre-requisites:

Students enrolled in M100 must be concurrently enrolled in A215: Basic Human Anatomy.

Learning Goals

A student who successfully completes M100 should achieve the following learning goals:

1. Recognize and implement learning and study skills that best fit a particular situation.
2. Explain and differentiate most major body systems.
3. Implement anatomical knowledge in clinical situations.

Goal	Core Competency	Assessment
• Recognize different ways you learn effectively and introduce these methods into your studying regimen	• Effectively analyze your exam performance • Utilize multiple study methods • Recognize when methods are not successful	• Blogs • Survey about study habits
• Explain and differentiate most major body systems	• Compare and contrast the functions of each body system • Describe how these major body systems interact with one another	• Final grade • In class and out of class activities
• Implement anatomical knowledge in clinical situations	• Connecting various symptoms and pathologies to the body systems affected	• Problem based learning exercises

Course Assessments

These assignments are designed to help you succeed in Anat A215. Students will be assessed in the following ways:

7. **Prior to Each Class Session**

a. **Blogs (5points each, 75 points total) -** Blogs will primarily be used for your personal evaluation of your own study strategies. A topic of discussion for each blog will be posted by the instructor in the "Blogs Beta" section of Oncourse, and your post for each blog will be due by the beginning of class (10:10a.m.) each Friday.

b. **Outline (5 points each, 60 points total) –** Prior to most class sessions you are expected to create an outline of the material covered in A215 during that week**.** These outlines should be organized in a manner which is meaningful to you (i.e. not just copy and pasting the notes directly from lecture). These will be graded on completeness, thoroughness, originality. Outlines may be typed and submitted online (via Oncourse) or handwritten and turned in at the beginning of class. Outlines are due by the beginning of class (10:10a.m.) each Friday.

8. **Participation** (**2 points per day, 30 points total**) – You will earn 2 points for participating during M100. Participation does not include holding side conversations with classmates, texting, playing games or talking on your cell phone, sleeping, etc. If you have a legitimate reason for your cell phone to be out in class you must LET ME KNOW IN ADVANCE, otherwise points will be deducted. *Should you need to miss class I expect you to contact me prior to missing class, at which point we can discuss the potential for making up missed points.*

9. **Daily Question (2 points per question, 30 points total)** – Each class meeting will begin with a multiple choice question about information covered that week in A215. A correct answer with worth 2 points.

10. **Problem Based Learning Exercises (PBL) (10points each, 40 points total) –** In class you will be given a scenario with a patient who is presenting a range of symptoms. It will be up to you and your group to determine a list of differential diagnoses (e.g., a list of all of the reasonable possibilities as to what may be wrong with the patient), and answer the questions included in the case. This will be possible with the information being covered in Anatomy A215.

11. **Study Logs (10 points per set, 40 points total) -** These logs will be given before lecture exams. You will be responsible for recording where and when you studied, along with how productive you felt you were during that study time.
A complete set of study logs will include 3 logs, one completed each day for three days prior to lecture exams, and a one-paragraph reflection on the completed logs.

12. **Study Exercises (5 to 10 points each, 30 points total) -** Throughout the course of the semester various worksheets, and assignments will be provided in order to gain experience with different options for studying the material that you may not have used before.

13. **Histology Slides (5 points per set, 20 points total) -** Before each set of A215 exams you will be asked to create and submit five histology questions to via Oncourse. I will then compile these questions into a quiz which will be taken in class for points. Complete directions are located on Oncourse under Resources. These slides are due by 6p.m. on the Thursday before each histology quiz.

14. **Histology Quizzes (15 points each, 60 points total) –** As described above, the histology slides you submit will be compiled into a 15 point quiz which will be given in class.

Point Totals:

Blogs	75
Outlines	60
Participation	30
Daily Question	30
PBL	40
Study Logs	40
Study Exercises	30
Histo Slides	20
Histo Quizzes	60
Total	385

The grade cutoffs will be as follows:

E- 90%
F- 80%
G- 70%
H- 60%

LATE POLICY

Assignments turned in within 24 hours of the original due date may receive partial credit. Blogs and outlines submitted late, but within 24 hours of the due date, can receive at most 3 out of 5 points. All assignments turned in later than 24 hours after the due date will receive no credit.

WITHDRAWALS AND INCOMPLETES

I will adhere to Indiana University policies, which state:

- A grade of Incomplete (I) may be given only when the work of the course is substantially completed and when the students work is of passing quality (*Indiana University Bulletin, College of Arts & Sciences*). If a student is given an incomplete, the existing exam grades remain "on the books" for the student and the student may make up only that material that he/she had to miss.
- If your dean permits you to withdraw after the date for an automatic W, the course director will give you a W (if your grade is D- or better) or an F (if your grade at that point is an F).

ACADEMIC MISCONDUCT

This includes, of course, cheating: "A student must not use or attempt to use unauthorized assistance, materials, information, or study aids in any academic exercise..." It also includes interference: "A student must not steal, change, destroy, or impede another student's work" *(Code of Student Rights, Responsibilities and Conduct.)* I will adhere to the University's guidelines for penalties and procedures (e.g. notifying the Dean of Students).

MSCI M100 Spring 2012

Date	In Class Activities	Due by the Beginning of Class
1/13	Intro – Review Syllabus Tissue Worksheet (in class)	Outline (O), Blog (B)
1/20	Managing Material	O, B
1/27	PBL 1	O, B
***2/3**	**Histology Quiz** Review	Histo Slides (DUE 6pm 2/2) B
2/10	Muscle Drawings	Study Logs O, B
2/17	PBL 2	O, B
2/24	**Histology Quiz**	Histo Slides (DUE 6pm 2/23) O, B
***3/2**	Review	B
3/9	Cranial Nerve Mnemonics?	Study Logs O, B
3/16	SPRING BREAK	
3/23	PBL 3	O, B
***3/30**	**Histology Quiz** Review	Histo Slides (DUE 6pm 3/29) B
4/6		Study Logs O, B
4/13		O, B
4/20	No Class BUT YOU STILL HAVE A **HISTOLOGY QUIZ**	Histo Slides (DUE 6pm 4/19) O, B
4/27	PBL 4	O, B

*These dates correspond with Anatomy A215 lecture exams.

Appendix F: MSCI M100 Course Proposal

Course Request:
Seminar in Human Anatomy (M101)

Course Description:

This course is designed to provide students who are concurrently enrolled in A215: Basic Human Anatomy a deeper insight into learning and metacognitive skills. Bettering these skills will allow students to improve understanding of how they learn and how to apply those skills in anatomy/science courses. The course will be include PBLs (problem-based learning exercises), case studies, and other exercises to promote active learning.

We plan for this class to be a 1 credit course, offered during the Summer II Session, 2010. We hope to meet twice a week for 1-1.5 hours. We will be including a variety of activities and selected problem based learning sets regarding anatomy. Ultimately we would like to have this class be on the books for future semesters, so every semester it can be offered as an option alongside A215. As an addition to A215, graduate students would be in charge of the course, much like A.I.'s in A215 labs. Since we are not sure how many students will elect to take this class, we propose the graduate students would receive a slight salary increase for teaching A215 and M101. If there are enough students enrolled in M101 that multiple sections are needed, it is then possible a separate M101 A.I. would be hired to cover all sections. The main work load of the class – journals, pre-lecture quizzes, PBL's- will be made into modules that, if necessary, can be modified by the graduate students.

In order to follow through with this course we need at least 5 students to enroll for the summer session, and enrollment will be capped at 50 students for the summer session. In the Fall and Spring semesters we will require a minimum of 15 students and a maximum of 50 students. If greater numbers of students are interested in the fall/spring we would like to open multiple sections for the course.

Why Do We Want to Offer This Course:

In our experiences teaching A215 we have observed many students who lack the proper study skills to succeed in the course, or become overwhelmed the vast amount of material covered. M101 would be a helpful tool for those students who are either overwhelmed by the thought of A215 or for those students who may need a little more direction in how to study. We want to offer this course in order to help students be successful in A215, and successful in the rest of their undergraduate careers. We also want to offer this course to do educational research that can be applied to courses across the campus here at I.U. We hope that this course will help us to test theories in

educational research regarding problem based learning, while incorporating metacognition and testing our own theories.

What We Hope to See:

For the summer of 2010 we hope to see an increase in overall A215 grades from M101 students. We realize that academic success relies on many factors; therefore simply analyzing exam scores of M101 students will not be adequate to truly see the impact of M101 on students. Because of this we will also concentrate on qualitative focus groups, student interviews, student journals and questionnaires

In order to determine if students are gaining anything from this course we plan to use our own observations, surveys and journal writings from the beginning of the course to the end. By comparing these surveys, we hope to see increased specificity of students' questions about material, a greater awareness of how the material was learned, and an increase of deep learning as opposed to surface learning. We also hope to see students improve their understanding of how to utilize learning exercises, as well as more frequently using available resources and even creating their own learning tools. Throughout this course, students will be using a variety of simple and complex learning strategies to help themselves understand the material. In the words of Nobel Laureate Herbert Simon "the meaning of 'knowing' has shifted from being able to remember and repeat information to being able to find and use it." We hope to give students the skills to move past just "memorizing and regurgitating" information.

Student Benefits:

By taking this course we hope students will develop/improve their current study skills which can be applied to A215 and future courses. While we will focus on helping students succeed in A215, the skills gained will be useful in other areas of science, as well as other disciplines.

Potential Educational Research:

- This summer, as a pilot run for the course, could also serve as a pilot study for our various research questions.
- Research regarding the effect that this class may have on students who are remediating A215
- We hope to publish a paper on the development of this course.

J. Smith

I never thought about how I learned. I do not know where I picked up my study skills or how I decided they were right for me. It was not until I entered graduate school that I began to learn about *how* I learn and learn about other ways that may be helpful to me. The skills and processes that I have learned this year are those that I would have loved and used as an undergraduate student. We want M101 to be a class that teaches

awareness of learning by using a variety of exercises, including problem based learning so that students have the widest array of study options open to them.

For many undergraduates Anatomy is a course that is a lot of memorizing, and to some degree the way anatomy curricula are set up perpetuates this ideal. Here in Bloomington, A215 is fighting to get past that. Problem based learning has been shown to be a great way to help students to connect course information to real life situations. "Short term memory is enhanced when people are able to chunk information into familiar patterns" (Bransford et al., 2001). One of my goals in this course is to stimulate the learning of anatomy into "familiar patterns" by using problem based learning.

In addition to researching the metacognitive aspects of this course, I would also like to use the development of M101 as my creative thesis to complete my degree. I believe that the developmental process of this course may be of interest to other educators, and could lead to a possible publication.

Audra Schutte

M101 will not serve the sole purpose of remediating students who were unable to pass A215 in a previous semester, but we hope that these students will sign up for M101. Many of the students who take A215 are freshmen. Research is showing that many students entering college are not adequately prepared for college-level courses (Bettinger & Long, 2006). My experiences teaching the A215 lab reinforce this claim. Many students quickly become overwhelmed with the amount of material and a lack of knowledge about how to approach learning the material. I would like to examine the effects M101 has on those students that are remediating A215. I plan to look at their exam grades and overall course grade, in comparison to the first time they took A215. I would also like to administer a survey at the beginning and end of the summer, asking students about their perceptions of their own metacognition and factors affecting their academic success. I plan to analyze M101 activities completed by these students to identify changes in their approach to the learning process. I hope to see, at the end of the summer, that the students who remediate A215 and take M101 will successfully complete A215, and develop skills that will benefit their entire college academic experience. I will hopefully be able to see the long term benefits through focus groups during the following school year.

Methods of assessment

Multiple methods of assessment are needed to adequately understand the impact of M101 on participating A215 students. We plan to use both quantitative and qualitative methods, and we will be obtaining IRB approval for our methodologies and research plans.

Quantitative Research involving:

- Cumulative Grade Point Averages from M101 students will be compared to all A215 students. This will help us to determine if the students in M101 are representative of the overall student population who take A215. We will be providing a pre-class survey on which students will be asked to voluntarily supply their overall G.P.A.
- A215 Lecture and Lab Exam Scores- The comparison of G.P.A.'s will be important in determining if we can really compare exam scores. If the G.P.A.'s of M101 are not representative of A215 students then it would be difficult to show that exam scores are related to M101. In this case we will be relying more on qualitative research.
- ACT & SAT Scores: We plan to also ask students to volunteer their ACT or SAT (verbal & math) scores as a part of a survey.

Qualitative Research involving:

- A precourse and postcourse survey will be administered to the M101 students. This survey will asses:
    - Reasons for taking M101
    - Overall motivation for studying for A215
    - How student's feel they learn best
    - Science/Math anxiety
    - Test anxiety

  At the end of the course we hope that this will show that students feel that the course has given them a greater motivation to study for A215, and that the study skills learned in M101 helped them succeed in A215. We also hope that students will be more aware of study strategies that work for them, demonstrating a gain in metacognitive skills. It will also be valuable to gather if students have discovered new ways of studying, that they feel, are better suited to them than their old habits.
- Additional surveys will be given to students as class assignments. One such survey will assess Deep vs. Surface Learning of M101 students.
- Journal entries: these online entries will be students' reflection on the material they find difficult in A215 and learning styles they are using in order to learn. If these are helpful it may even be a tool that can then be implemented into A215. A journal entry may be set up in the following manner:

What is the Muddiest Point?	Strategies Used to Learn
	Did you feel like these strategies were helpful? Why or why not?

- Online quizzes before classes. These quizzes will be two parts. A pre-quiz, to determine if students have done reading over that day's topic, and a post-quiz after a brief introduction over the days material. The readings will be both from the A215 text and articles posted on Oncourse regarding learning techniques and styles.
- Selected interviews/ focus groups-
  - M101 students- we would like to hear their views on anatomy in general, the study methods that we presented, and if they feel that those methods would help them study in other undergraduate courses.
  - We would also like to interview a group of A215 students who did not take M101. By interviewing them we hope to understand the reasons why they chose not to take M101, study methods they used in A215 and their views on anatomy and how they felt the course went for them.

If there are no observed A215 score improvements in M101 students:

- We plan to reevaluate what course work involved
- It could possibly be that more required work on top of A215 in a short time period is overwhelming for students
- Overall, A215 summer students tend to do well, making it difficult to determine how helpful M101 would be in the fall or spring semesters

What we are asking of the Undergraduate Education Committee:

We are for approval to submit new course paperwork for M101, so that we may pilot M101 in the Summer of 2010. We are also asking that we, J. Smith and Audra Schutte, are allowed to teach M101 and A215 this summer. We will report our findings to the committee in the fall. We are also asking, if the course is successful, that M101 be put on the books for the Spring 2011 semester.

Appendix G: MSCI M100 Sample PBL

Digestive PBL

Mike has been really stressed lately due to his ridiculous anatomy class that is not only taking all of his time, but the stress from class is causing Mike to have constant headaches. To relieve his headaches, Mike has been taking extra ibuprofen every day this summer. In the last couple weeks Mike has been experiencing a burning pain in his epigastric region, which gets worse after eating. He also has experienced nausea and despite adjusting his diet, he's belching a lot more often than normal.

- What do you think is causing Mike's nausea, belching and pain in the epigastric region?

Mike finally decides that he should go to the doctor. The doctor tells him that he has developed a gastric ulcer.

- What is an ulcer?

- What are the layers of the stomach wall (describe the general layers and the specific structures within those layers)?

As it turns out, most ulcers are caused by the bacteria Helicobacter pylori, so the doctor prescribes Mike an antibiotic. He also prescribed Mike an antacid to help reduce gastric acidity, in turn promoting healing, and recommends he cuts back on the ibuprofen (which is linked to ulcers).

- The acidic nature of the stomach is a big part of breaking down and digesting our food. How is it that we aren't all walking around with ulcers?! What prevents gastric juices from eating away at the stomach itself?

- How do gastric juices compare to pancreatic juice (what are they each made of and what is their function)?

Appendix H: Early and Late Semester Surveys

Name: _____
A215 Lab Section Day/Time: _____

Early Semester Learning Attitudes Assessment

Demographics
Please circle the answer that best describes you.

1. What is your gender?
    a) Female
    b) Male
2. What is your race/ethnicity?
    a) American Indian
    b) Asian-American
    c) African-American
    d) Hispanic
    e) White
    f) Other, please specify:
3. What is your year in college?
    a) Freshman
    b) Sophomore
    c) Junior
    d) Senior
    e) 5^{th} year
    f) Graduate Student
    g) Continuing Studies Student
4. What is your age in years?
    a) Younger than 18
    b) 18
    c) 19
    d) 20
    e) 21
    f) 22 or older, if older please specify:
5. What is your enrollment status?

    a) Part-time student (enrolled in less than 12 credit hours this semester)
    b) Full-time student (enrolled in 12 or more credit hours this semester)
    c) Other, please specify:

6. Are you the first member of your immediate family to attend a 4-year, undergraduate institution?

    a) yes
    b) no
    Additional comments:

7. Are you in regular contact with at least one family member (by phone, text, email, etc.)?

    a) yes, approximately 1-2 times per week
    b) yes, approximately 4 times per week
    c) yes, daily
    d) no, I am not in regular contact with family

8. If you have a job, is it on or off-campus? You may select more than one.

    a) On-campus
    b) Off-campus
    c) I do not have a job

9. If you have a job, how many hours per week do you work?

    a) Less than 10 hours per week
    b) 10-20 hours per week
    c) 20-30 hours per week
    d) 30-40 hours per week
    e) More than 40 hours per week

10. Please indicate how many hours per week you are involved in any of the following extracurricular activities. If you are not involved in some or any of these activities you may indicate this by marking zero hours per week or leaving it blank.

Extracurricular Activity	Hours per week
Performance ensembles	
Sports clubs	
Intramurals	
Religious groups	
Special interest and advocacy groups	
Academic clubs	
Honor societies	
Student government	
Research	
Greek-letter social fraternities and sororities	
Student publications	
Other, please specify:	

11. During a typical week during the semester, how many hours do you spend studying?

    a) Less than 1 hour
    b) 1-2 hours
    c) 3-6 hours
    d) 7-10 hours
    e) 10+ hours

Part 2

The following questions are meant to assess your comfort with various aspects of the learning process, as well as your predicted habits related to studying for Anatomy A215. Please circle the answer that best matches your comfort level or habits.

1. How comfortable are you asking questions in A215 **lecture**?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

2. How comfortable are you asking questions in A215 **lab**?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

3. How comfortable are you locating resources that are academically useful?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

4. How comfortable are you identifying specific strategies for learning that meet your needs?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

5. How comfortable are you self-assessing (identifying what you do and do not understand)?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

6. How comfortable are you with keeping your course materials organized?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

7. How comfortable are you managing your time?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

8. How comfortable are you synthesizing and applying information presented in class, not just memorizing for exams?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

9. How often do you review the instructor's posted notes during a regular (non-exam) week?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

10. How often do you supplement your learning with other resources (websites, etc)?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

11. How often do you study with a partner or group for A215 **lecture**?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

12. How often do you study with a partner or group for A215 **lab**?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

13. How often do you use the publisher-provided support materials?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

Name: _____
A215 Lab Section Day/Time: _____

Late Semester Learning Attitudes Assessment

Demographics
Please circle the answer that best describes you.

1. What is your gender?
    c) Female
    d) Male
2. What is your race/ethnicity?
    g) American Indian
    h) Asian-American
    i) African-American
    j) Hispanic
    k) White
    l) Other, please specify:
3. What is your year in college?
    h) Freshman
    i) Sophomore
    j) Junior
    k) Senior
    l) 5^{th} year
    m)Graduate Student
    n) Continuing Studies Student
4. What is your age in years?
    g) Younger than 18
    h) 18
    i) 19
    j) 20
    k) 21
    l) 22 or older, if older please specify:
5. What is your enrollment status?

    d) Part-time student (enrolled in less than 12 credit hours this semester)
    e) Full-time student (enrolled in 12 or more credit hours this semester)
    f) Other, please specify:

6. Are you the first member of your immediate family to attend a 4-year, undergraduate institution?

    c) yes
    d) no
    Additional comments:

7. Are you in regular contact with at least one family member (by phone, text, email, etc.)?

    e) yes, approximately 1-2 times per week
    f) yes, approximately 4 times per week
    g) yes, daily
    h) no, I am not in regular contact with family

8. If you have a job, is it on or off-campus? You may select more than one.

    d) On-campus
    e) Off-campus
    f) I do not have a job

9. If you have a job, how many hours per week do you work?

    f) Less than 10 hours per week
    g) 10-20 hours per week
    h) 20-30 hours per week
    i) 30-40 hours per week
    j) More than 40 hours per week

10. Please indicate how many hours per week you are involved in any of the following extracurricular activities. If you are not involved in some or any of these activities you may indicate this by marking zero hours per week or leaving it blank.

Extracurricular Activity	Hours per week
Performance ensembles	
Sports clubs	
Intramurals	
Religious groups	
Special interest and advocacy groups	
Academic clubs	
Honor societies	
Student government	
Research	
Greek-letter social fraternities and sororities	
Student publications	
Other, please specify:	

11. During a typical week during the semester, how many hours do you spend studying?

f) Less than 1 hour
g) 1-2 hours
h) 3-6 hours
i) 7-10 hours
j) 10+ hours

Part 2

The following questions are meant to assess your comfort with various aspects of the learning process, as well as your habits related to studying for Anatomy A215. Please circle the answer that best matches your comfort level or habits.

1. How comfortable are you asking questions in A215 **lecture**?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

2. How comfortable are you asking questions in A215 **lab**?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

3. How comfortable are you locating resources that are academically useful?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

4. How comfortable are you identifying specific strategies for learning that meet your needs?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

5. How comfortable are you self-assessing (identifying what you do and do not understand)?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

6. How comfortable are you with keeping your course materials organized?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

7. How comfortable are you managing your time?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

8. How comfortable are you synthesizing and applying information presented in class, not just memorizing for exams?

1	2	3	4	5
Not at all Comfortable	Somewhat Comfortable	Comfortable	Somewhat Comfortable	Extremely Comfortable

9. How often do you review the instructor's posted notes during a regular (non-exam) week?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

10. How often do you supplement your learning with other resources (websites, etc)?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

11. How often do you study with a partner or group for A215 **lecture**?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

12. How often do you study with a partner or group for A215 **lab**?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

13. How often do you use the publisher-provided support materials?

1	2	3	4	5
Never	Rarely	Once in a while	Sometimes	Almost Always

Appendix I: Complete Survey Results

Part 1 of Survey

Survey Item	1 (Not at all Comfortable)	2 (Somewhat Comfortable)	3 (Comfortable)	4 (Very Comfortable)	5 (Extremely Comfortable)
1: Asking questions in lecture	9.1	40.9	29.5	15.9	4.5
	12	20	32	24	12
2: Asking questions in lab	0	4.5	20.5	15.9	59.1
	0	0	12	0	88
3: Locating academically useful resources	4.5	13.6	34.1	29.5	18.2
	0	12	32	36	20
4: Identifying useful strategies for learning	0	13.6	52.3	25	9.1
	0	12	24	52	12
5: Self-assessing knowledge	0	18.2	34.1	31.8	15.9
	8	20	28	20	24
6: Keeping course materials organized	4.5	4.5	13.6	29.5	47.7
	0	8	32	32	28
7: Managing time	6.8	20.5	34.1	25	13.6
	8	28	28	24	12
8: Synthesizing and applying information presented in class	6.8	38.6	29.5	25	0
	8	32	24	24	12

Part 2 of Survey

Survey Item	1 (Never)	2 (Rarely)	3 (Once in a While)	4 (Sometimes)	5 (Almost Always)
9: Review the instructors notes in regular week	2.3	11.4	34.1	25	27.3
	8	20	40	32	0
10: Supplement learning with other resources	6.8	9.1	31.8	31.8	20.5
	4	16	24	36	20

11: Study with partner or group for lecture	11.6	30.2	18.6	27.9	11.6
	24	16	28	16	16
12: Study with partner or group for lab	2.3	9.3	25.6	20.9	41.9
	16	12	24	16	32
13: Use publisher-provided support	9.3	20.9	18.6	30.2	22.7
	16	12	34	16	32

***values listed in this table are the percentage of responses for each response option of each survey item**

Early Semester Survey Results (n=44)
Late Semester Survey Results (n=25)

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Wright, S. J. (2012). Student perceptions of an upper-level, undergraduate human anatomy laboratory course without cadavers. *Anatomical Sciences Education, 5*(3), 146-157. doi: 10.1002/ase.1265

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Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-Motivation for Academic Attainment: The Role of Self-Efficacy Beliefs and Personal Goal Setting. *American Educational Research Journal, 29*(3), 663-676.

Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology, 82*(1), 51.

Curriculum Vitae

Audra Faye Schutte

EDUCATION:

Ph.D. Education Track in Anatomy
Indiana University, Bloomington, Indiana, May 2013
Advisor: Valerie Dean O'Loughlin, PhD
Dissertation: Remediation Trends in an Undergraduate Anatomy Course and Assessment of an Anatomy Supplemental Study Skills Course

M.P.H. Public Health
Indiana University, Bloomington, Indiana, May 2009
Thesis: Reproductive Health Knowledge of College Students

B.A. Biology
Wartburg College, Waverly, Iowa, May 2007

TEACHING EXPERIENCE:

Associate Instructor for A550-551: Medical Gross Anatomy
August 2011-May 2013
Indiana University
- Assist medical students with cadaveric dissection
- Set-up and grade laboratory exams
- Assist students with identification of structures on cadavers, radiographs, models and cross-section images

Associate Instructor for M131: Disease and the Human Body
January 2013-May 2013
Indiana University
- Present 10 lectures on topics of my choosing (I am one of four lecturers for the course)
- Write exam covering material from those 10 lectures
- Proctor each of 4 lecture exams

Associate Instructor for A215: Basic Human Anatomy
August 2007-December 2012
Indiana University
- Introduce laboratory material to undergraduate students
- Present structures on cadavers to students in lab and assist students with models and histology slides

Course Developer and Instructor for M100: Improving Study Skills in Anatomy
June 2010- May 2012
Indiana University

- Developed the course with another graduate student
- Teach undergraduate students study methods related to basic human anatomy course
- Review and clarify information from anatomy labs and lectures

Associate Instructor for M555: Medical Neuroscience
January 2011-May 2011
Indiana University

- Assist presenting laboratory material to medical students
- Set-up and grade exams
- Assist students with identification of structures on preserved specimens, MRIs, and microscope slides

Associate Instructor for A560: Medical Cell Biology & Histology
August 2010-December 2010
Indiana University

- Introduce laboratory material to medical students
- Write, set-up and grade exams
- Assist students with use of microscopes and identification of structures and tissues

Laboratory Assistant: Teaching Practicum in Biology
September 2006-May 2007
Wartburg College

- Prosect a cadaver for current Mammalian Anatomy & Physiology class
- Present structures of the cadaver to students in lab

RESEARCH EXPERIENCE:
PhD Dissertation Research
January 2010-May 2013

- Researching remediation trends in undergraduate human anatomy course
- Assessing the effectiveness of an undergraduate study skills course that is taught concurrently with anatomy
- Utilized SPSS for univariate and multivariate statistical analyses
- Developed a codebook for analysis of qualitative data

MPH Thesis Research
June 2008-May 2009

- Researching college students' knowledge of reproductive health
- Developed a survey to assess knowledge
- Used SPSS for statistical analysis of survey results

Senior Research Experience: Methods of Biological Research
September 2006-May 2007
Wartburg College
- Researching the migrational capabilities of ovarian cancer cells
- Learning and performing multiple lab procedures, including cell cultures and Western Blots

Molecular Genetics Lab Assistant
Summer 2006
University of Nebraska Medical Center
Omaha, Nebraska
- Assisted lab technicians in ongoing research projects in lab
- Aided in maintaining safe working environment

COURSES PREPARED TO TEACH:
Basic Human Anatomy
Human Gross Anatomy
Human Microscopic Anatomy
Human Neuroanatomy
Study Skills in Anatomy

RESEARCH INTERESTS:
- Student remediation of undergraduate anatomy
- Student attitudes toward cadaver use in the undergraduate anatomy lab and whether attitudes are related to student success in the course
- Effectiveness of supplemental instruction for undergraduate anatomy

PRESENTATIONS:
1. Schutte, A. (2012). Improving learning skills in anatomy. Workshop at Human Anatomy & Physiology Society Annual Conference in Tulsa, OK.

2. Schutte, A. (2012). Analysis of study logs in an anatomy learning skills course. Poster presentation at Experimental Biology AAA Meeting in San Diego, CA.

3. Keller, J., & A. Schutte. (2011). Improving learning strategies in anatomy. Poster and platform presentation at Experimental Biology AAA Meeting in Washington D.C.

4. Schutte, A. (2011). Remediation trends in an undergraduate anatomy course. Poster presented at Experimental Biology AAA Meeting in Washington D.C.

PUBLICATIONS:
1. Keller, J., & A. Schutte. (2011). What we learned from teaching about learning. *HAPS Educator15(2)*: 23-25.

2. Schutte, A., & M. Braun. (2009). Virtual microscopy: experiences of a large undergraduate anatomy course. *HAPS Educator1(1)*: 39-42.

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2012 Lippincott Williams Wilkins/AAA Education Research Scholarship ($5000)

AWARDS & HONORS:
- Outstanding Associate Instructor Award, Medical Sciences Program, Indiana University, April 2012
- American Association of Anatomists (AAA) Student/Postdoc Education Research Poster Award Finalist 2012
- American Association of Anatomists (AAA) Student/Postdoc Education Research Poster Award Winner, April 2011 (Keller & Schutte)
- American Association of Anatomists (AAA) Student/Postdoc Education Research Poster Award Finalist, April 2011 (Schutte)

PROFESSIONAL AFFILIATIONS:
Human Anatomy and Physiology Society (HAPS)
American Association of Anatomists (AAA)
- Elected to Student/Postdoc position on AAA Board of Directors, term to begin April 2013