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A mixed methods investigation of first-year medical students' competency development in the gross anatomy laboratory context.

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A MIXED METHODS INVESTIGATION OF FIRST-YEAR MEDICAL STUDENTS' COMPETENCY DEVELOPMENT IN THE GROSS ANATOMY LABORATORY CONTEXT

By

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B.A., Bellarmine University, 2020
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DEDICATION

This dissertation is dedicated to my Grammy and my Pap-Pap.

I never would have asked either of you to read this whole thing, but I sure wish you were still here to celebrate its submission with me.

ACKNOWLEDGMENTS

First and foremost, I must acknowledge Dr. Jennifer Brueckner-Collins, my mentor. I could not have done this without your unwavering support, guidance, understanding, and encouragement. You are truly a superhero.

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My best friend, Devyn. You have been by my side for 11+ years, and even with being long-distance, our friendship has never been closer. I am so grateful for your constant support, daily video messages, and your fierce protection of my mental health.

ABSTRACT

A MIXED METHODS INVESTIGATION OF FIRST-YEAR MEDICAL STUDENTS' COMPETENCY DEVELOPMENT IN THE GROSS ANATOMY LABORATORY CONTEXT

Emily M. Porta-Miller

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Competency-based medical education and competency assessment are common in the clerkship years of undergraduate medical education and in graduate medical education; however, they are less commonly included in the preclinical, or basic science, years of medical education. This study investigated the effects of a novel competency-based curricular thread which assessed Communication, Teamwork, and Professionalism competency development of first-year medical students in the gross anatomy lab context. The study employed a convergent parallel mixed methods approach. The quantitative phase used a pretest/posttest design with paired dependent *t*-tests to determine if students' exhibited growth, stagnancy, or decline within any of the three competencies over the semester. The analysis resulted in three main conclusions: 1) students exhibited statistically significant self-assessed and peer-assessed growth in the Communication competency, 2) students did not exhibit statistically significant self- or peer-assessed change in the Teamwork competency, and 3) students exhibited peer-assessed statistically significant growth in the Professionalism competency. The qualitative phase of the study involved grounded theory analysis of students' 3-part competency

development portfolio entries to determine what skills students believed they already possessed in each competency, what skills they set goals to improve upon, and how they felt about their progression in each competency over the course of the semester. The qualitative analysis revealed three main themes that students expressed development within for each competency: Imparting Information, Gathering of Information, and Team Communication skills within the Communication competency; Collaboration, Team Engagement, and Conflict/Problem Solving skills within the Teamwork competency; and Interpersonal Relations/Social, Responsibility, and Gross Anatomy lab skills within the Professionalism competency. The findings of this study indicate that competency-based assessments can and should be included in the gross anatomy lab context for first-year medical students to begin to familiarize themselves with aspects of competency-based medical education they will receive in the future.

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INTRODUCTION

Competency-based education is a budding paradigm in professional education. The calls for competency-based approaches to preparing professionals such as chiropractors, social workers, teachers, pharmacologists and more go back over 70 years (Englander et al., 2017; Frank et al., 2017; Frank et al., 2010). Within the medical field, calls for competency-based medical education (CBME) go back more than 60 years (Englander et al., 2017; Frank et al., 2010). The definition of CBME continues to be highly variable in the literature (Englander et al., 2017; Frank et al., 2010; Holmboe et al., 2017). Frank et al. (2010) proposed a definition for CBME as "an outcomes-based approach to the design, implementation, assessment, and evaluation of medical education programs, using an organizing framework of competencies." Holmboe et al. (2017) goes further by describing CBME as an approach to and philosophy of designing the explicit progression of health professionals through an amalgam of principles and approaches that must constantly evolve to meet the fundamental aim of achieving better health care for all through more effective medical education. Some of CBME's fundamental characteristics are that it involves more emphasis on needs-based graduate outcomes, promotion of learner-centeredness, and accomplishment of curricular competencies (Frank et al., 2010; Holmboe et al., 2017). The focus on outcomes in CBME better aligns with the missions of medical education and health care delivery by developing competent physicians who

are multi-dimensional and lifelong learners (Frank et al., 2010; Lockyer et al., 2017). CBME is fluid in that there are no standardized rules that would prevent an educational program from applying several theoretical perspectives to its design, implementation, and evaluation (Holmboe et al., 2017).

CBME was promoted by McGaghie et al. (1978) in a visionary report for the World Health Organization. In this report, the authors urged for the global adoption of CBME to ensure that health professions education could meet local and regional population health requirements (Frank et al., 2017; McGaghie et al., 1978). The 1993 Tomorrow's Doctors initiative in the United Kingdom was the guiding framework for the international shift to the new competency-based models of postgraduate medical education (Iobst et al., 2010). The Association of American Medical Colleges (AAMC), the Accreditation Council of Graduate Medical Education (ACGME), and the American Board of Medical Specialties (ABMS) have been creating, editing, and implementing sets of competencies, guidelines, and milestones for medical residents since 1998 (*Competency-Based*, n.d.).

However, it was not until 2004 that competency-based medical residency programs began to be implemented globally—the United States, the United Kingdom, Canada, Australia, India, and the Netherlands being amongst the first countries to do so (Frank et al., 2017). Now, CBME has been widely adopted internationally and implemented in many postgraduate medical education (PGME) programs for the clinical training of medical residents. In these competency-based residency paradigms, the training programs must clearly establish and define graduate abilities and promote the progression of competence in *all* the essential aspects of medical practice, such as the

aspects of professionalism, medical knowledge, interpersonal communication, etc. In order to advance in training in these programs, residents must demonstrate competence in the abilities required for the successful delivery of medical care (Iobst et al., 2010). Although there has been widespread adoption of CBME variations for medical resident education internationally, little has been done to implement aspects of CBME across *undergraduate* medical education programs, especially in the United States.

The AAMC Group on Student Affairs Committee on Admissions developed and endorsed a set of 15 core competencies for students applying to and entering medical school that fall under four umbrella categories: Interpersonal, Intrapersonal, Thinking and Reasoning, and Science Competencies (*Core Competencies,* n.d.). These competencies are steppingstones to the six core competencies that the ACGME and ABMS endorsed in 1999 that are used to evaluate medical residents and that reflect the skills necessary of practicing physicians (*Competency-Based,* n.d.; *#ACGME2021,* 2021). Those six core competencies are Patient Care, Medical Knowledge, Professionalism, Systems-based Practice, Practice-based Learning, and Interpersonal and Communication Skills (Edgar, 2020; Kavic, 2002).

Currently, internationally, there is no alignment of undergraduate medical education (UME) objectives/competencies with those in the postgraduate medical education settings, which have been heavily described and implemented over the last 25 years (Crawford et al., 2020; Dwyer et al., 2016; Garofalo et al., 2017; Rabski et al., 2021; Schultz & Griffiths, 2016). Specifically in the United States, a large gap resides in that there are 15 defined competencies for entering American undergraduate medical education programs, and 6 defined competencies for American medical residents who

have graduated medical school, but no defined competencies or standardized CBME approaches for students *in* American undergraduate medical programs. Many institutions have begun to define specific undergraduate competencies, but there is no standardized approach to this process. Alignment of objectives, competencies, and outcomes across these two educational settings would allow CBME to frame the educational trajectory more effectively across the medical training continuum—medical school through residency and beyond (Fazio et al., 2018). Therefore, it is appropriate that American UME programs consider implementing aspects of CBME to better prepare their graduates for residency programs.

A paradigm shift to CBME in undergraduate medical programs will take time and deliberate effort. Harris et al. (2010) notes that residency programs use a competency-based framework to describe activities and performance of *practicing* medical professionals. Therefore, undergraduate programs will need to work backward to build "enabling competencies" in the undergraduate curriculum to provide an authentic curriculum focused on the "qualities and attributes required in a competent physician." Harris et al. (2010) describes an example to illustrate this difference: "the concepts and practice of health promotion will be designed differently for learners early in their undergraduate career (who might, for example, be required to describe principles) than for graduates in hospital practice (who might be asked to implement individual strategies)." Curricular components in undergraduate programs should thus be designed to foster the acquisition of "enabling skills" which can relate to several competency domains (Harris et al., 2010).

The AAMC, ACGME, and AACOM are currently working together to gather information from the medical community (educators, physicians, medical students, residents, etc.) to create a common set of foundational ("enabling") competencies for use in UME programs in the United States (*Foundational Competencies*, n.d.). From March 2023-Early 2024 and beyond, this Foundational Competencies working group plans to develop foundational competencies for UME that align within the six-core competency framework of GME and then have the medical education community engage in efforts to adopt the competencies for use in their programs (*Foundational Competencies*, n.d.). Their goal is to create a common CBME framework for UME institutions in the United States, but ultimately the medical schools themselves will determine their own ways to utilize the foundational competencies within their curricula.

The University of Louisville School of Medicine (ULSOM) is already including competencies within their UME Mission as they have a set of Program Objectives that undergraduate medical students should be able to achieve by graduation. These objectives fall under eight competencies: Patient Care, Knowledge for Practice, Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Professionalism, Systems-Based Practice, Interprofessional Collaboration, and Personal and Professional Development (*School* of, n.d.). Several of these competencies are primarily evaluated in the students' third and fourth years of education during their clinical rotations and interactions with patients. This research project seeks to include competency education and assessment within the preclinical years of medical education at the University of Louisville.

The primary goal of this research study is to support the ULSOM Mission and our first-year medical students by contributing to the education and assessment of the Interpersonal and Communication Skills, Professionalism, and Personal and Professional Development Competencies. This project intends to respond to the recent calls to the medical education community from the Foundational Competencies working group to provide input to help inform their future recommendations for the UME foundational competencies and how to assess them. This research also intends to contribute to the AAMC's current Strategic Plan's first action item: to strengthen the medical education continuum by fostering innovation in CBME in emerging areas and diverse educational settings, specifically within UME (*Action Plan*, n.d.).

In the Fall of 2022, first-year medical educators at the University of Louisville implemented a novel competency-based curricular thread to the Clinical Anatomy, Development, and Examination (CADE) course that addressed and evaluated Communication, Teamwork, and Professionalism competencies in the gross anatomy laboratory context. This was a pilot effort to incorporate competency education and assessment within the first year of medical education at the ULSOM. Through analysis of this pilot program, this dissertation aims to showcase how the gross anatomy laboratory is an optimal place of opportunity to implement several aspects of CBME in the first year of medical education. Most specifically, this study demonstrates how Communication, Teamwork, and Professionalism competency assessment can and should be implemented into team- and dissection-based gross anatomy courses in the first year of medical school at UME institutions.

CHAPTER 2

LITERATURE REVIEW

In order to truly frame the educational trajectory most effectively across the medical training continuum, CBME should be implemented in the basic science years of training for medical students (years 1 and 2). CBME is intended to tailor education to the requirements of medical practice, and this starts with integrating medical school curricula across disciplines and emphasizing the basic sciences that underpin subsequent clinical training (Gregory et al., 2009). The primary literature is limited when investigating CBME in the learning of basic sciences; however, recently some institutions have begun to implement and study CBME in the basic science years in their gross anatomy courses (Gregory et al., 2009; Jalali et al., 2020; Naidoo et al., 2020; Pandit et al., 2019).

Amongst the basic sciences, anatomy is frequently being considered a logical starting point for implementing CBME because traditional anatomy courses already include experiential laboratory sessions as well as didactic classroom sessions (Jalali et al., 2020). Escobar-Poni and Poni (2006) specifically describe how the AAMC, ACGME, and National Board of Medical Examiners want to see the core competency of Professionalism taught and evaluated across medical school, and how the Gross Anatomy laboratory is the perfect place of opportunity to implement Professionalism assessment. The Gross Anatomy laboratory with cadaveric dissection provides a space for students to confront and learn from their “first patient” and is an opportune way for faculty to

quickly identify and remediate early manifestations of unprofessional behavior and other competency deficiencies in medical students (Escobar-Poni & Poni, 2006). The gross anatomy course typically occurs in the first semester of medical education, and students spend several weeks in the lab, working in teams, and learning from their faculty, each other, and their cadaveric donors. Therefore, incorporating and assessing competencies in the Gross Anatomy laboratory offers the opportunity to incorporate ACGME and AAMC competencies in the first year of medical school.

Adopting CBME is a challenge for traditional medical curricula, including anatomy departments which historically focused on key aspects of the human form and complex functional interrelations (Shiozawa et al., 2020). However, students have traditionally engaged in, developed competence in, and learned about competencies such as professionalism, communication, and teamwork in anatomy classes even if they had not received explicit instruction about them—this is often referred to as the "hidden curriculum" (Shiozawa et al., 2020). Many of the competencies that could be considered "enabling skills" (Harris et al., 2010) are experienced and absorbed through role modeling of faculty members and fellow medical students in the lab or classroom (Shiozawa et al., 2020). In this context, anatomy instruction and education can play a crucial role in competency development and assessment, since anatomy is in many undergraduate curricula the first experience of a "medical" discipline with a cadaver as a student's first "patient" (Escobar-Poni & Poni, 2006; Shiozawa et al., 2020). Few measures are regularly implemented in preclinical medical education for assessing competencies such as professionalism, the most common being reflective approaches (Shiozawa et al., 2020) and peer and self-evaluation (Gregory et al., 2009). With

mounting evidence from scientific studies, it is now widely acknowledged and accepted that fostering self-reflection in medical students is an appropriate way to teach and assess the competency of professionalism and anatomy education has an extremely powerful environment at hand to teach and assess professionalism in the dissection course (Mann et al., 2009; Sandars, 2009(Shiozawa et al., 2020).

The Medical Council of India undertook a comprehensive revision of their undergraduate medical curriculum and implemented a new curriculum entitled "Competency Based Undergraduate Curriculum for the Indian Medical Graduate" in 2019 and 2020 (Ramanathan et al., 2021). The CBME undergraduate curriculum in India lists 2,949 competencies to be mastered by medical students and lists suitable teaching-learning and assessment methods, with the pivotal aspect of the new curriculum being the shift from knowledge accumulation to skill acquisition (Ramanathan et al., 2021). Some of the new curricular elements include early clinical exposure, small group teaching, a foundations course, structured feedback, and maintenance of logbooks and reflective learning. Students must perform under observation in skills laboratory, take personal responsibility for learning by adopting self-directed learning methods, and encounter real and simulated patients (Ramanathan et al., 2021).

A research study by Pandit et al. (2019) sought to assess the efficacy of their CBME method compared to the traditional structured method in the teaching of first-year medical students in a cadaver-based anatomy course at the Armed Forces Medical College in Pune, India. A set of competencies were determined and evaluated on domains related to motor skills, communication, knowledge, and attitudes (Pandit et al., 2019). The students in the CBME group were given formative assessments and formative

feedback, as well as a final summative assessment, while the students in the traditional structured method group were only given the final summative assessment. The study results indicated significant improvement in the scores of students who had the CBME interventions versus the students who only received the traditional structured method (Pandit et al., 2019). Many students indicated that CBME and feedback reinforced their learning and that they appreciated the practical relevance of the introduced competencies, which will be a major factor in their later years of medical practice (Pandit et al., 2019).

As this new competency-based curriculum for undergraduate medical students in India has been implemented, the desire to assess the students' perspectives on the curriculum has arisen. Ramanathan et al. (2021) conducted a cross-sectional study among first-year medical students (2019-2020) across various medical colleges in India using multistage sampling. The aim of the study was to assess the first-year medical students' perceptions and opinions on the CBME curriculum, discussing its advantages, limitations, and suggestions for future directions to make UME more learner-centric (Ramanathan et al., 2021). Respondents included 987 students from 74 medical colleges across India, and overall, 89.3% viewed CBME positively and 88.5% viewed the new curricular implementations positively (Ramanathan et al., 2021).

For comparison, Jalali et al. (2020) at the University of Ottawa in Ontario, Canada, implemented a competency-based approach to teaching anatomy based on a selection of CanMEDs roles and competencies. For their study, they compared a new anatomy-based learning stream (a modified team-based learning model) to the traditional stream using two separate groups of students. The students in the anatomy-based learning stream were put into teams and participated in group discussions, groupwork at cadaver

stations, and received feedback from facilitators, while the traditional stream students were given traditional didactic teaching and those students did not actively engage in the laboratory (Jalali et al., 2020). The study found that there was not a significant difference in scores for students in the anatomy-based learning method versus the students in the traditional stream method. However, when comparing students in the lowest quartile of each group, the students in the anatomy-based learning section obtained relatively higher final scores than the students in the traditional stream group (Jalali et al., 2020). Jalali et al. (2020) claim they successfully restructured their traditional basic science course using specific competencies as templates and that the introduction of these competencies will enable students to better understand the progression and significance of their anatomy learning and produce increased levels of engagement within the anatomy laboratory component of their medical training.

At the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU), a pedagogical framework for anatomy education was implemented in their competency-based medical curriculum. This pedagogical framework, a blended model comprised of Gagne's 9-step and Peyton's 4-step instructional model/approach, was implemented during the Head and Neck structure-function course and it allowed faculty to assess cognitive and noncognitive skills of the first-year medical students (Naidoo et al., 2020). Overall, the framework was received positively by the medical students who recommended its integration across all structure-function courses due to the framework integrating a real clinical scenario and implementing student-centric active learning strategies (Naidoo et al., 2020). Naidoo et al. (2020) suggest that using their pedagogical

framework in a competency-based medical curriculum will allow a more effective delivery of anatomy teaching and will address the integration gap between basic sciences and clinical sciences.

The Mayo Medical School in the United States underwent a curricular redesign which incorporated and emphasized the ACGME six core competencies into UME. This redesign resulted in integrating first-year gross anatomy, embryology, and radiology into one course entitled “Human Structure” (Gregory et al., 2009). Gregory et al. (2009) claim that the Human Structure course as a basic medical science with stark clinical relevance is an excellent framework within which faculty can introduce educational interventions targeting the six ACGME core competencies. Some examples of educational interventions they introduced to target the six ACGME core competencies were: informal teaching within dissection teams through daily peer-to-peer interactions (Practice-based learning and improvement competency), self- and peer evaluations completed weekly, and feedback is provided (Professionalism competency), students work with same dissection team for 12 weeks with rotating leadership (Interpersonal and communication skills competency) (Gregory et al., 2009).

Three of the aforementioned studies concerned CBME being used for undergraduate medical students in cadaver-based laboratories at institutions outside of the United States. Due to this consideration, the findings described may not be generalizable to studies in the United States but give further indication that research on competencies and CBME in American undergraduate medical education is necessary and important. The AAMC developed a 10-step Strategic Plan in 2020, and Action Plan #1 is to Strengthen Medical Education, with two of the four major goals over the subsequent five

years being “the medical education community implements CBME in new and emerging areas in diverse educational settings; U.S. medical schools move toward uniform adoption of a set of foundational competencies for undergraduate medical education that aligns across the medical education continuum” (*A Healthier*, n.d.; *Action Plan*, n.d.). CBME is the key theme for research projects and activities supporting Action Plan #1.

CBME inherently does not mandate any specific teaching strategies, philosophies, or assessment methods. However, some philosophical approaches are implicit in the demands of attaining competence: flexibility of design, constructive alignment of learning activities with assessments, student-centeredness, active engagement, and spiral development of concepts, knowledge, and skills are all needed for the effective implementation of CBME (Harris et al., 2010). The expectation is not that medical students will reach true independence of supervision in undergraduate training, but rather that this process of familiarizing students with the language and frameworks of competency assessment will contribute to shaping their eventual independent, professional identities (Fazio et al., 2018) and contribute to their success as medical residents and practicing physicians, by helping to bridge the gap between undergraduate and graduate medical training.

In conclusion, in order for medical education to successfully shift to CBME, CBME must be implemented across the medical education continuum from basic science courses in medical school to clinical science in residency to independent medical practice (Fazio et al., 2018; Frank et al., 2010; Harris et al., 2010). In developing competency-based curricula, it is important to understand that attaining “competence” will look different for a medical student versus a resident. The term “competent” should be used

with modifiers that specify which domains of ability, which context, and what stage of medical education or practice the term “competent” refers to (Frank et al., 2010). Introducing the concept of CBME, with formative and summative assessments of competencies, into the gross anatomy lab setting for undergraduate medical education has been effective and positively perceived by students (Gregory et al., 2009; Jalali et al., 2020; Pandit et al., 2019; Ramanathan et al., 2021). By introducing CBME in basic science years of UME programs, the expectation is not that medical students will reach expertise in competencies they are introduced to but rather that the process of familiarizing students with the language and framework of competency-based education will contribute to their future success as medical residents participating in competency-based curricula.

CHAPTER 3

OVERVIEW OF METHODOLOGY

Overview of Research Design

Using a convergent parallel mixed methods design, this medical education research project has three main goals: 1) quantitatively assess the competencies of Communication, Teamwork, and Professionalism of first-year medical students in the gross anatomy lab context over time, 2) explore and contextualize the personal experiences of the students' competency development over time, and 3) develop a holistic, multi-dimensional understanding of the students' development in each competency over time. Thus, for this study, we intend to assess students quantitatively and qualitatively on their Communication, Teamwork, and Professionalism competency development in the gross anatomy laboratory context over time. This mixed methods research approach was conducted using a pragmatic philosophical worldview (Creswell, 2009). As a pragmatic mixed methods researcher, one engages in many approaches for collecting and analyzing data, uses both qualitative and quantitative data because they work to provide the best understanding of a research problem, and establishes rationales for the reasons why the qualitative and quantitative data need to be mixed in the first place (Creswell, 2009).

A convergent parallel mixed methods design, also known as concurrent triangulation strategy, was chosen for this study due to the nature of the data collection methods (Creswell, 2009). Both quantitative (QUAN) and qualitative (QUAL) data were

collected concurrently in the fall of 2022. After the concurrent data collection, the quantitative data was analyzed through statistical analyses and the qualitative data was analyzed using coding, thematic analysis, and grounded theory principles. Once the separate quantitative and qualitative analyses occurred, the two databases were directly compared to determine if there was convergence, divergence, or some combination between the two sets of results. Through this process of methodological triangulation, the use of separate quantitative and qualitative methods can offset the weaknesses inherent within one method with the strengths of the other (Creswell, 2009; Heale & Forbes, 2013). This traditional mixed methods approach is advantageous because it can result in well-validated and substantiated findings, as well as avoid potential biases that can arise from the use of just a single methodology (Creswell, 2009). Refer to Figure 3.1 for a visual description of this methodology. The rationale for using a mixed methods study design was that neither the qualitative nor quantitative methods alone were sufficient to answer all the research questions, nor to fully understand the process of first-year medical students' competency development over time. Used simultaneously, qualitative, and quantitative methods allowed for a more holistic analysis of the data and a clearer understanding of the research problems.

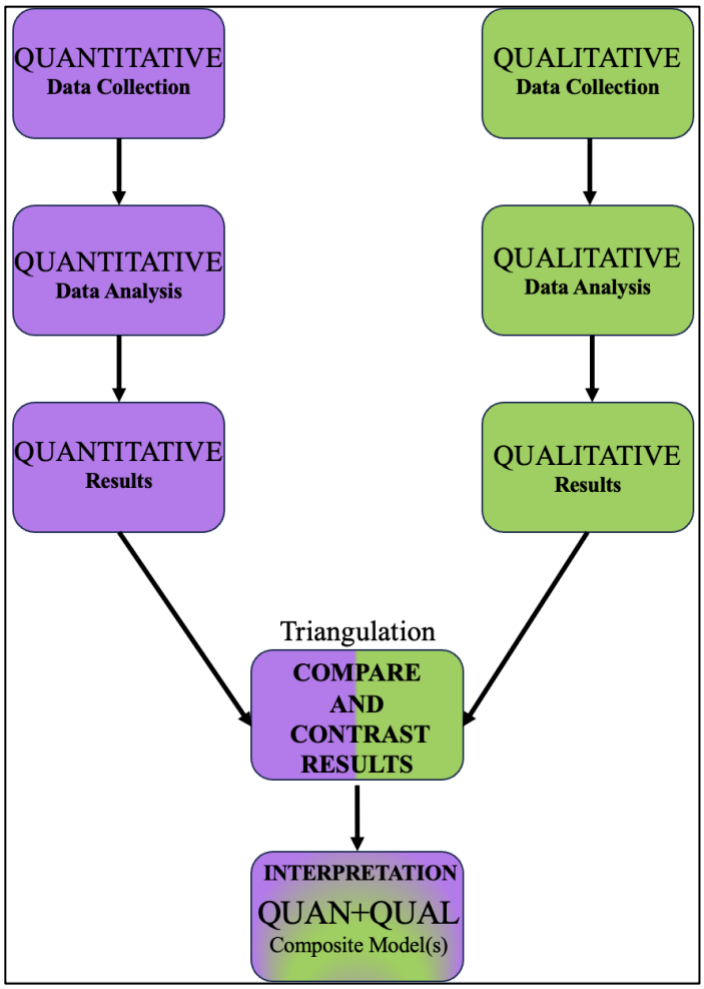

Figure 3.1. Convergent Parallel Mixed-Methods Design Visual Model. Sources: Creswell and Clark (2007) and Creswell (2009)

This study, using self- and peer- quantitative assessments at the beginning and end of the Fall 2022 semester, sought to determine whether first-year medical students at the University of Louisville School of Medicine exhibit change within the three competencies of Communication, Teamwork, and Professionalism over the Clinical Anatomy, Development and Examination (CADE) course. The study also qualitatively examined those first-year medical students' Competency Development Portfolios (CDPs) containing student reflections on their baseline status, progress, and development within each of the three competencies during the CADE course. For this study, the data was

retrieved retrospectively from graded assignments that were introduced as part of the inaugural competency-based curriculum in the CADE course during the fall of 2022.

Organization of CADE Course

The CADE course is separated into five "Blocks" throughout the fall semester. Each Block corresponds to a different aspect of the human body (e.g., Block 1 is dedicated to the Upper Limb, Block 2 is to Lower Limb, etc.).

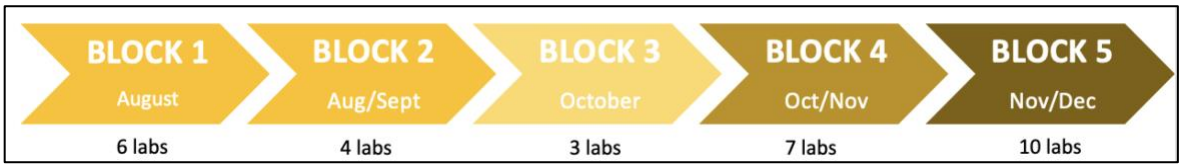

Figure 3.2. Organization of CADE course

At the start of the CADE course, all ~160 first-year medical students are assigned to a cadaveric donor at a table within a zone in the gross anatomy lab. There are roughly 28 tables utilized for medical gross anatomy each fall. 6-7 students are assigned to each donor, and those 6-7 students are further subdivided into teams of 3-4 students, represented by groups A and B. The students are in these A and B teams all semester long at the same table and with the same cadaveric donor, and they alternate dissection days throughout the semester (30 lab sessions total). For example, Group A will dissect the forearm and cubital fossa on Monday, then Group B will dissect the hand on Wednesday. Before Group B dissects the hand on Wednesday, one member from Group A will be responsible for teaching Group B the content learned from Monday's cubital fossa and forearm lab.

Materials

In the fall of 2022, CADE instructors introduced quantitative self-/peer-assessments on Communication, Teamwork, and Professionalism skills, Anatomy Team

Charters (ATCs) (Dougherty et al. (2018)), and competency development portfolio (CDP) assignments as a part of the competency-based curriculum for use in the gross anatomy lab context. The self- and peer-assessment and CDP assignments were utilized as the data materials for this project.

Quantitative Materials

Three previously validated instruments were selected for these assignments and subsequently slightly modified for the gross anatomy laboratory context.

1) The Communication Assessment Tool (CAT) adapted from Trickey et al. (2016) and (Makoul et al., 2007).
2) The Team Performance Scale (TPS) adapted from Thompson et al. (2009).
3) The Professionalism Assessment Scale (PAS) adapted from Hammer et al. (2000).

For each instrument, a self-assessment (SA) version and a peer-assessment (PA) version were created because students were asked to self-assess using each instrument as well as assess their gross lab table mates (peers) using each instrument. A copy of each instrument's self- and peer-versions can be found in the Appendices. The assessments differ in the constructs to be measured as described in Table 3.1.

Table 3.1

Quantitative Instruments

	Description
CAT-SA-1	A 14-item scale that seeks to measure self-assessed levels of communication skills at the beginning of the semester.
CAT-SA-2	A 14-item scale that seeks to measure self-assessed levels of communication skills at the end of the semester.
CAT-PA-1	A 14-item scale that seeks to measure levels of communication skills of peers at the beginning of the semester.

CAT-PA-2	A 14-item scale that seeks to measure levels of communication skills of peers at the end of the semester.
TPS-SA-1	A 17-item scale that seeks to measure self-assessed levels of teamwork skills at the beginning of the semester.
TPS-SA-2	A 17-item scale that seeks to measure self-assessed levels of teamwork skills at the end of the semester.
TPS-PA-1	A 17-item scale that seeks to measure levels of teamwork skills of peers at the beginning of the semester.
TPS-PA-2	A 17-item scale that seeks to measure levels of teamwork skills of peers at the end of the semester.
PAS-SA-1	A 24-item scale that seeks to measure self-assessed levels of behavioral professionalism skills at the beginning of the semester.
PAS-SA-2	A 24-item scale that seeks to measure self-assessed levels of behavioral professionalism skills at the end of the semester.
PAS-PA-1	A 24-item scale that seeks to measure levels of behavioral professionalism skills of peers at the beginning of the semester.
PAS-PA-2	A 24-item scale that seeks to measure levels of behavioral professionalism skills of peers at the end of the semester.

Quantitative Methodology

Pretest/Posttest Experiment

Due to the nature of the administration of the quantitative assessments, the quantitative aspect of this study has a pretest/posttest design which intends to characterize student progress in each competency domain. For each competency domain and their respective pre-assessment instruments, students self-assessed as well as peer-assessed their lab table mates during Block 1 of the CADE course in August of 2022. Throughout August, September, and the beginning of October, competency-specific tasks were assigned or occurred in the gross anatomy lab course—Anatomy Team Charters (ATCs), competency development portfolios (CDPs), peer teaching, peer assessment, receiving feedback, and anatomy lab experiences (e.g., continuous care for anatomic donors, etc.).

At mid-semester in Block 3 prior to the administration of the post-assessment instruments, students were provided with faculty and peer feedback for each competency domain based on the pre-assessments from Block 1. Assessment plus feedback is one of the central tenets of CBME, and feedback is considered necessary for students to further develop skills within a competency domain (Edgar, 2020; Holmboe et al., 2010). Competency-specific tasks and anatomy lab experiences continued throughout the semester, and then for each competency domain and their respective post-assessment instruments, students self-assessed as well as peer-assessed their lab table mates. After the post-assessments were administered in the middle of Block 5, students received a final round of faculty and peer feedback at the end of the semester based on the post-assessments.

Refer to Figure 3.3 for a visual description of this methodology and how it fit into the CADE course.

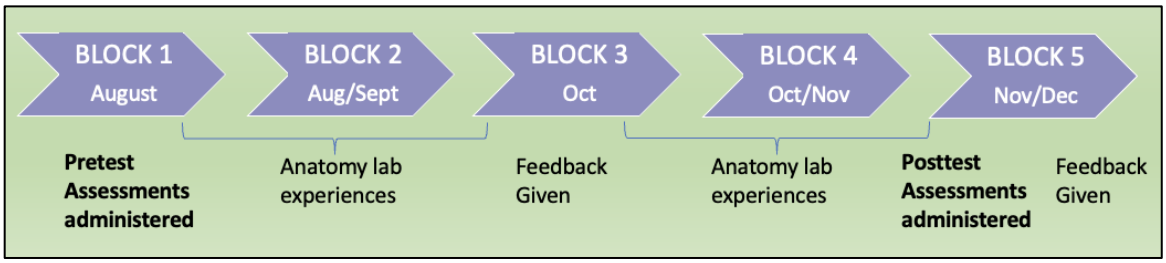

Figure 3.3. Timeline of Quantitative Assessments Administration

Statistical Analyses: Dependent Paired t-tests

The purpose of the quantitative phase of this study was to determine how first-year medical student self- and peer-assessments within each competency domain change over time. Dependent paired sample *t*-tests were used on the pre-assessment/post-assessment data for the CAT, TPS, and PAS self- and peer-assessments. A paired samples *t*-test is most appropriate for each tool because the data were collected from the

same group of students at two different time points. The paired samples *t*-test indicates whether there is a statistically significant difference in the mean scores for Time 1 and Time 2 (Pallant, 2016). Effect size statistics were calculated for each of the pre- to post-assessments to determine the strength of the differences between Time 1 and Time 2. Effect sizes for all significant *t*-tests were calculated using Cohen's d (Cohen, 1988). For Cohen's d, .2 = small effect, .5 = medium effect, and .8= large effect (Cohen, 1988). All statistical analyses were conducted using IBM SPSS Statistics Version 29.0. A significance value of $p \leq 0.05$ was used to indicate statistical significance between data sets.

To further validate the significance, a Bonferroni correction was performed to adjust for multiple statistical comparisons being made in the same study (Armstrong, 2014). As the number of statistical tests increases in a study, so does the likelihood of a type I error (determining that a significant difference exists when it does not) (Alfaro et al., 2019; Armstrong, 2014). For the Bonferroni correction, the error rate is: $(1 – (1 - \alpha)/T)$ where "α" is the originally set critical *p* value and "*T*" is the number of statistical tests performed (Armstrong, 2014). For our study, the new type I error rate is set to be at 0.05 (α) divided by 6 (the number of statistical tests, *T*). This adjusted significance level of α/T is 0.0083. The Bonferroni correction is then applied to the *p* values associated with each individual test to maintain the α level over all tests at 0.05 (Armstrong, 2014).

Table 3.2

Statistical Analyses: dependent (paired) t-tests in SPSS

Self-Assessments	N	Bonferroni Adjusted Significance Level for All *t*- tests
CAT-SA-1 to CAT-SA-2	83	
TPS-SA-1 to TPS-SA-2	83	
PAS-SA-1 to PAS-SA-2	83	
		$p \leq 0.0083$
Peer-Assessments		
CAT-PA-1 to CAT-PA-2	83	
TPS-PA-1 to TPS-PA-2	83	
PAS-PA-1 to PAS-PA-2	83	

Reliability Analyses

For this study, previously validated scale instruments (CAT, TPS, and PAS) were used to preserve *content* and *construct* validity. Items on each scale were proofread and edited for clarity, and slightly modified for the gross anatomy lab context. For our purpose of assessing reliability of these instruments in the context of the gross anatomy laboratory, the internal consistency of each scale will be estimated using Cronbach's α with a desired overall value of .80. An α coefficient of .70 has been regarded as an acceptable threshold for reliability; however, .80 is preferred for the psychometric quality of scales (Boateng et al., 2018). Cronbach's α is used to determine whether a collection of items on a scale consistently measures the same characteristic. It quantifies the level of agreement on a standardized 0 to 1 scale. Values closer to one indicate a higher level of agreement between items on the scale. This consistency indicates the measurements are reliable and the items on the scale likely measure the same characteristic. Cronbach's α is identical to the Intraclass Correlation Coefficient (ICC) when the ICC is calculated using

the two-way mixed effects model models within SPSS. As such, Cronbach's α/Intraclass Correlation Coefficient (ICC) confidence intervals will be reported with the Cronbach's α results to demonstrate the range of reliability of each scale (Bravo & Potvin, 1991).

Qualitative Methodology

The qualitative phase of this study aims to understand first-year medical students' baseline status, progress, and development within each of the three competencies during the CADE course. This was completed using thematic content analysis with grounded theory methodology on first-year medical student competency development portfolio (CDP) entries which students completed at the beginning, middle, and end of the CADE course.

Materials

The 3-part Competency Development Portfolio (CDP) was created for first-year medical students to reflect upon their skills, goals, and progress in each competency domain throughout the CADE course. A copy of each part of the CDP can be found in Appendix E.

1) CDP Part One: Baseline Status and Goal Setting
2) CDP Part Two: Goal Revision/Brief Reflection
3) CDP Part Three: Summative Reflection/Goals Moving Forward

First-year medical students completed the three entries for their CDPs during the CADE course in the fall of 2022. The first entry occurred at the beginning of the semester, where students identified strengths and weaknesses within each competency and set goals for the semester within each competency. The second entry occurred mid-semester after students had received their first round of faculty feedback for each competency domain.

In this second entry, students reflected on their progress in each competency and revised their initial goals (or created new goals) for each competency. The third entry occurred at the end of the semester after students had received their final round of faculty feedback for each competency domain. In this third and final entry, students provided a summative reflection on their progress in each competency and created a plan for continued maintenance of each competency post-CADE and into the medical field.

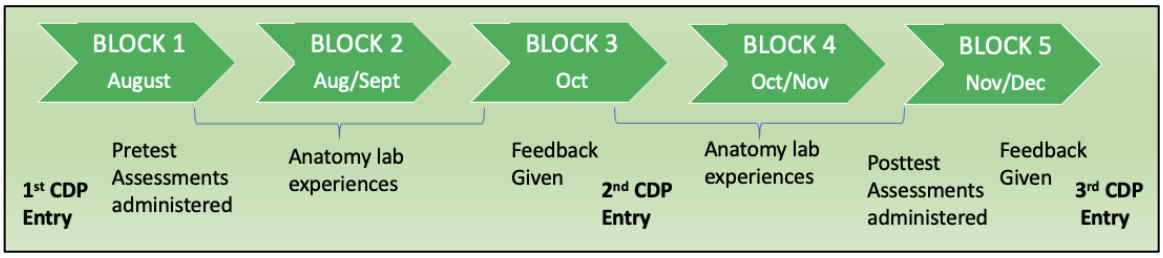

Figure 3.4. Timeline of Qualitative Assessment Administration

Thematic Analysis & Grounded Theory

Grounded theory is a form of qualitative analysis in which the researcher generates an explanation of a process shaped by the views of the study subjects. The intent of a grounded theory study is to move beyond description and to generate or discover a theory for a process or an action (Creswell and Poth, 2018). In our case, the processes we are investigating are first-year medical student competency development in Communication, Teamwork, and Professionalism in the gross anatomy lab context over time. The theory development is generated, or "grounded" in text data from the study subjects who have experienced this process (first-year medical students) (Creswell and Poth, 2018).

Grounded theory has many characteristics that can be adopted, adapted, and incorporated into qualitative research studies (Charmaz, 2014; Creswell and Poth 2018). The process to develop grounded theory can be aided by thematic analysis using open,

axial, and selective coding. Through using our text data from the student CDPs, the first step was to open code the text data, where we analyzed the text data for its major categories and themes of information and created codes to represent those themes. The next step is axial coding, in which one identifies prominent themes present and open coding categories to focus on and then goes back to the data to create categories around those core themes. The final step is selective coding and theory generating, where one takes the axial coding categories and develops propositions that interrelate the categories or assembles a story that describes the interrelationship of categories. Creswell and Poth (2018) discuss how grounded theory provides qualitative researchers with this procedure for developing categories of information (open coding), interconnecting the categories (axial coding), and building a "story" that connects the categories (selective coding) to end with a set of theoretical propositions. CDP entries were coded until it was determined that inductive thematic saturation was reached for the main categories and themes that erupted from the data during constant comparison of the dataset. Inductive thematic saturation relates to the emergence of new codes or themes--when no new codes or themes emerge, data analysis can stop (Saunders et al., 2018). To reach the degree of saturation, the researcher must identify concepts, develop them, and relate them (Moura et al., 2022). To accomplish this comprehensive process, we used the qualitative data management and analysis software MaxQDA version 22.5.0.

CDP entries were coded until it was determined that saturation was reached for the main categories and themes that erupted from the data during constant comparison of the dataset. Once this coding process was complete, selective coding across all three CDP entries was used to determine the most common themes and categories students discussed

within their communication competency development over the CADE course. These themes and their categories were then used to generate theories and propositions that described the interrelationship of the themes and categories to describe student perceptions on communication skill development in the gross anatomy lab context

Triangulation

One of the goals of this study is to develop a multi-dimensional, synergistic understanding of the complexity behind student competency development over the CADE course, as well as to seek corroboration and convergence, or the opposite (divergence) of findings from the qualitative and quantitative methods which are studying the same phenomenon. (Davies et al., 2012; Dawadi et al., 2021; Heale & Forbes, 2013). In the convergent parallel mixed methods research design, the triangulation process is an approach in which two different kinds of data sets' results are combined to get a complete picture of the issue, or phenomenon, being explored and to validate one set of findings with the other (Creswell and Poth, 2018; (Dawadi et al., 2021). Triangulation is the use of two or more methods to "see" the phenomenon of interest from different perspectives and through different lenses. Through side-by-side analysis, information from both the quantitative results and qualitative results were directly compared. This side-by-side integration is typically seen in published mixed methods studies where a discussion section provides quantitative statistical results followed by qualitative quotes that support or disconfirm the quantitative results (Creswell, 2009). Therefore, a triangulation approach was used to ensure the validity of the study with three main instruments (self-assessments, peer-assessments, CDPs) used to assess the questions: what is the process (baseline status, progression, development) of first-year medical students'

Communication, Teamwork, and Professionalism competency development over the CADE course? How do the students' progress throughout these competencies over the course?

In this study, the quantitative data and dependent *t*-tests provided insight into whether first-year medical students exhibit growth, stagnancy, or decline within each competency during the CADE course, but were inadequate to address the complexity behind *why* a competency might exhibit any of those features. Having the students give short but detailed qualitative responses on strengths and weaknesses in each competency, goals for development, and how they progressed throughout a competency gave the opportunity to understand the growth, stagnancy, or decline exhibited quantitatively. Through integrating and comparing the results from both forms of data, one could develop a more holistic understanding of how first-year medical students go through Communication, Teamwork, and Professionalism competency development over time in the gross anatomy lab context.

Study Population, Inclusion and Exclusion Criteria

The study population consisted of de-identified first-year medical students who were enrolled in the CADE course at the ULSOM during the fall of 2022 (ULSOM Class of 2026) who completed the semester and were in good standing to continue their medical education at the ULSOM into the spring of 2023. First-year medical students who did not complete the fall 2022 semester were excluded.

Research Permission

IRB Exempt

The University of Louisville Institutional Review Board (IRB) reviewed this study and determined it was exempt according to 45 CFR 46.101(b) under Category 2: Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording). This study was also approved through 45 CFR 46.117(c), which means that an IRB may waive the requirement for the investigator to obtain a signed informed consent form for some or all subjects. All study personnel completed and maintained Human Subjects & HIPAA Research training throughout the duration of the study.

Data Collection

Retrospective data collection

When the CADE course was completed and grades had been assigned to all first-year medical students in the Class of 2026 (mid-December 2022), students were emailed with the option to opt-out of the study and have their assignment data withdrawn from any future analysis. After a three-week waiting period, no students had withdrawn their assignments from data collection/analysis. Throughout January-February of 2023, all student data housed in Microsoft Forms was downloaded, converted to Microsoft Excel files, and subsequently stripped of all identifying information. After removing all identifying information within every assignment, case IDs were created for each assignment utilizing the random number generator feature in Microsoft Excel. This was to make sure the qualitative and quantitative data on each subject would have the same

identifiers, as well as to ensure the dependent *t*-tests would be conducted correctly (e.g., ID16's PAS-SA-1 to ID16's PAS-SA-2). This process occurred prior to data cleaning; therefore, case IDs range from 1-164. Within the qualitative results sections of subsequent chapters, case IDs are utilized to differentiate quotations from different students.

Data Cleaning

Since the data was collected retrospectively from student assignments, there were instances where students did not complete all assignments or did not receive peer-assessment data due to their peer(s) not completing assignments. If a student did not complete an assignment or was missing a peer-assessment, all of their data was excluded from analysis. This was due to several reasons. For example, a student may have completed all quantitative self-pre-assessments in August, but then failed to complete one or more of the quantitative self-post-assessments in November. This would result in that student's quantitative and qualitative data being removed from analysis due to there not being any posttest data for that student. As another example, a student may have completed all their quantitative self-assessment assignments and CDP assignments but was missing data from the peer-assessments due to their peer(s) not completing the assignment. This would result in that student's quantitative and qualitative data being removed from analysis due to there being inadequate data for the peer-assessment pre/posttests. As a final example, a student may have completed all quantitative self-assessments and their peers may have completed all peer-assessments for them, but they may not have submitted one or more of their qualitative CDP assignments. This would result in that student's qualitative and quantitative data being removed from analysis due

to there being inadequate qualitative data to be analyzed for that student. This data cleaning process was necessary to ensure that every student included in the study had completed all CDP and self-assessment assignments and received all of their peer-assessments. This process resulted in a total of 83 students being included in the study.

To ensure that selection bias did not impact generalizability of data from these 83 subjects, analysis on the omitted student's quantitative data was performed. Comparable findings were observed for self- and peer-results with the exception of the Teamwork Performance Scale peer-assessment, which indicated growth from Time 1 to Time 2 with a p value of .007 compared to the study population p value of .055. The quantitative and qualitative analyses on the study population for Teamwork indicated that Teamwork is a complex construct that requires further investigation.

Ethical Considerations

While great care has been taken to thoughtfully design and develop this study, because it is a research project involving humans and their behavior, there will be limitations that may affect the study population, data collection, and analyses. One of the potential limitations to the study regards the data collection methods. As the main form of quantitative data collection are self- and peer-assessments, this can introduce the issues of social desirability bias and/or the Hawthorne effect (Ross & Bibler Zaidi, 2019). The implication of the social desirability bias is that students, in self-assessing, may rate themselves higher (or lower) than they should to appease the evaluator who will give the student a distinction along a competency scale from novice to proficient. Difficulty giving peers constructive feedback because of fear of retribution from negative scores and potential perceived lack of anonymity, or the inability to find shortcomings of their

peers, could lead students to allot false scores to their peers as well (Spandorfer et al., 2014). This bias can therefore threaten internal validity (Ross & Bibler Zaidi, 2019).

Several steps have been taken to attempt to mitigate this limitation. To account for the potential of social desirability bias, the students assessed their peers anonymously. They were aware that their peers were assessing them but had no way of knowing exactly how each of their peers assessed them. When faculty gave each student feedback, great care was taken to maintain the anonymity of each student and how they assessed their peers. Also, each of the competency assessment scales the students will be using to self- and peer-assess will contain no neutral option, therefore forcing each student to choose an item on the scale that behaviorally represents the way they or their peers behave in the gross lab setting.

Another method of mitigating the social desirability bias was that students completed these assessments outside of lab time, away from their peers. This should have reduced students' discomfort when answering potentially sensitive questions on the scales (Ross & Bibler Zaidi, 2019) and encourage honest and accurate responses. Utilizing self-administered questionnaires resulted in unobtrusive data collection which did not require the researcher to be present, therefore mitigating the potential Hawthorne effect. Through giving students a framework to assess their peers, like the communication assessment tool, this aided in the comfortability of providing feedback to peers and encouraged the ability to make behavioral changes based on peer feedback received.

A potential threat to the internal validity of the study results was present due to the testing effect from students repeatedly self- and peer-assessing and therefore the potential of assessment fatigue as a result. The potential of assessment fatigue of students

has been highly considered, so several steps have been taken to mitigate this limitation. First, all the assessments (self-, peer-, and portfolio entries) were internet-based and housed in Microsoft Forms utilizing the student university accounts in order to make each assessment efficient, familiar, and secure (Nousiainen et al., 2017). Each self- and peer-assessment should take approximately six minutes to complete, and this was noted clearly in the instructions of each assessment in Microsoft Forms, indicating the minimal amount of time each student would need to spend rating themselves and their peers and therefore mitigating assessment fatigue. Secondly, the study having a pre/posttest design allows for there to be time in between the first of the self- and peer-assessments and the last self- and peer-assessments. Thirdly, while this is also somewhat of a limitation, the self- and peer-assessments and portfolio entries that are a part of this study were curricular components of the gross anatomy course. Therefore, students were graded on the completion and quality of their feedback/portfolio entries. This will result in students having taken great care in the rating of themselves and their peers knowing that it was a part of their grade in the course to do so.

In the qualitative data analysis process, researcher/rater bias is a limitation that could occur during this study. This is because members of the research team were involved with seeing and reading the students' CDP portfolio entries during the CADE course in fall of 2022 for grading purposes. To mitigate this limitation, a few steps were taken. First, students were presented with the opportunity to retract their data from the study. After three weeks, when no one retracted their data, all possible identifiers were removed from all data. Lastly, preliminary qualitative analyses were not performed on the data until May of 2023, six months post-CADE course completion.

CHAPTER 4

A MIXED METHODS ANALYSIS OF FIRST-YEAR MEDICAL STUDENTS' COMMUNICATION COMPETENCY DEVELOPMENT IN THE GROSS ANATOMY LABORATORY CONTEXT

4.1. Introduction

Interpersonal and Communication Skills is one of the six general competencies endorsed by the ACGME and ABMS that is used to evaluate medical residents and reflects a skill necessary of a practicing physician (Kavic, 2002). The AAMC, AACOM, and ACGME are currently sponsoring an initiative to develop a common set of foundational competencies for use in UME programs within the United States as a comprehensive effort to improve medical students' transition to residency (*Foundational,* 2024). Interpersonal and Communication Skills will be reflected within these foundational competencies, and which will intend to represent minimum competencies for all medical students, regardless of degree type or eventual specialty of practice (*Foundational,* 2024). The ULSOM is already including Interpersonal and Communication skills as one of the core competencies within the school of medicine program objectives which all graduates should be able to demonstrate by graduation. Within this competency, graduates should be able to demonstrate interpersonal and communication skills that result in the effective exchange of information with patients, their families, and health professionals (*School of*, n.d.). Students typically work on developing these skills with standardized patients during their preclinical years of UME

and more so during their third and fourth years of clinical education in UME. We propose the gross anatomy laboratory with dissection-based learning as an opportune venue to implement Interpersonal and Communication skills competency assessment during the first year of UME.

An important, and often previously overlooked, aspect of medical communication involves the interactions between healthcare professionals. The recognition of the importance of medical team communication is growing due to how team communication influences the effectiveness of delivery of care (Borowczyk et al., 2023). Good communication between health care practitioners is essential for good medical care, and literature shows that poor communication skills among physicians contributes to dissatisfaction of patients (Manyama et al., 2016). With proper training, every medical school graduate should be able to communicate efficiently with members of the medical team (Borowczyk et al., 2023). With the increasing demand for communication skills training to be incorporated into UME, there is a need for the assessment of practical communication skills during UME.

A study by Bulte et al. (2007) demonstrated how peer teaching in the gross anatomy lab context could be utilized as a tool for assessing communication skills with professional peers during the first semester of medical school. ‘Doctor’ in Latin translates to ‘teacher’ and one of the key responsibilities of physicians is teaching (Bulte et al., 2007)—whether that be teaching their patients about their diagnoses, teaching their colleagues during the handover of patient care, or a multitude of other teaching activities. Peer teaching has been found to be an effective way for students to increase confidence and knowledge of anatomy (Brueckner & MacPherson, 2004; Manyama et al., 2016;

Youdas et al., 2008). Our study demonstrates how peer teaching can specifically be utilized as a tool to improve communication skills of first-year medical students in the gross anatomy lab context.

This phase of our mixed-methods investigation of competency development was intended to 1) quantitatively determine whether first-year medical students' self-assessments of the communication competency in the gross anatomy lab context exhibit change over time, 2) quantitatively determine whether first-year medical students' peer-assessments of the communication competency in the gross anatomy lab context exhibit change over time, 3) qualitatively analyze and contextualize student reflections on their baseline status, progress, and development of their communication competency throughout the gross anatomy course.

4.2. Materials and Methods

Overview of Methodology

This study was conducted under a convergent parallel mixed methods design (Figure. 3.1). The quantitative phase utilized a pretest/posttest design using the Communication Assessment Tool (CAT) developed by Makoul et al. (2007) and adapted from Trickey et al. (2016). The intervention between the pretest and posttest was peer teaching in the gross anatomy lab. The qualitative phase used student competency development portfolios (CDPs) developed for the inaugural competency-based curriculum in the CADE course at ULSOM as data materials. These portfolio entries were thematically analyzed using coding and grounded theory to describe how students perceive the development of their communication competency over the CADE course. The results from each phase of the study were then triangulated to give a holistic

description of first-year medical student competency development over time in the gross anatomy lab context.

Quantitative Materials and Methodology

First-year medical students at ULSOM in the fall of 2022 completed quantitative self- and peer-assessments of communication skills using the previously validated 14-item Communication Assessment Tool (CAT) adapted from Trickey et al., 2016) at the beginning and at the end of the gross anatomy course (n = 83). The CAT has been tested across several physician specialties demonstrating content and construct validity and high internal consistency (Trickey et al., 2016). The ACGME Advisory Committee endorsed the CAT for inclusion in the 2009 ACGME Toolbox (Swing et al., 2009). The CAT was originally developed for patients to assess communication of physicians across specialties (Makoul et al., 2007). It was validated for use in assessing general surgery resident communication (Stausmire et al., 2015), and validated for use in in assessing surgical residents' interpersonal communication skills in simulation scenarios (Trickey et al., 2016). The CAT consists of 14 physician-specific items written at a fourth-grade reading level scored on a Likert scale from 1 (poor) to 5 (excellent) (Trickey et al., 2016). We adapted the 14-item scale to assess first-year medical students' communication skills during peer teaching in the gross anatomy lab context. Self-assessment (CAT-SA-1 and CAT-SA-2) and peer-assessment (CAT-PA-1 and CAT-PA-2) versions were created and can be found in Appendix B.

The quantitative phase of this study included several statistical analyses including an internal reliability assessment of the CAT-self-assessments and CAT-peer-assessments for use in the gross anatomy lab context, dependent paired samples *t*-tests of the self- and

peer-assessment data, and measures of effect size. Data were analyzed within SPSS version 29.0, with a Bonferroni corrected significance level of $p \leq .0083$. Before conducting any statistical analyses, the data were examined to ensure that the assumptions of the statistical tests were met.

Gross anatomy lab setting – Peer Teaching

At the start of the CADE course, first-year medical students were assigned to a cadaveric donor at a table within a zone in the gross anatomy lab. There were roughly 28 tables utilized for medical gross anatomy each fall. Six to seven students were assigned to each donor, and those six to seven students were further subdivided into teams of three to four students, represented by groups A and B. The students were in these A and B teams all semester long at the same table and with the same cadaveric donor, and they alternated dissection days throughout the semester (30 lab sessions total). For example, Group A dissected the forearm and cubital fossa on Monday, then Group B dissected the hand on Wednesday. Before Group B dissected the hand on Wednesday, one member from Group A was responsible for teaching Group B the content learned from Monday's cubital fossa and forearm lab. At the beginning of the semester, after each student's first peer teaching session, they were asked to self-assess using the CAT-SA-1. The three to four peers that were taught during that session were responsible for peer-assessing the peer teacher using the CAT-PA-1. At the end of the semester, after each student's last peer teaching session, they were asked to self-assess using the CAT-SA-2. The same three to four peers that assessed them at the beginning of the semester were responsible for peer-assessing that peer teacher again using the CAT-PA-2.

Qualitative Materials and Methodology

The students completed three competency development portfolio (CDP) assignment entries throughout the CADE course (n = 83) in the fall of 2022. The first entry at the beginning of the semester asked students to reflect on their strengths and weaknesses within the communication competency and to develop SMART goals (Doran, 1981) for the competency. The second entry at mid-semester asked students to reflect on and track their progress in the communication competency thus far and to revise or set new goals in the competency for the remainder of the semester. The third entry at the end of the semester asked students to reflect on their progression in the communication competency throughout the semester and to make a plan for how they will continuously maintain and improve their skills in the competency as it relates to the medical field (Appendix E).

Thematic analysis and grounded theory principles were used to qualitatively analyze the students' responses in their CDPs in the qualitative data analysis software MaxQDA version 22.5.0. Students' CDP part 1 entries were initially read, then coded, and then axially coded to find the main themes and categories within those themes present in first-year medical students' strengths and weaknesses and goals set within the communication competency at the beginning of the semester. Students' CDP part 2 entries were then read, coded, then axially coded to find the main categories and themes present in students' progress in and reflections on their communication competency goals set at the beginning of the semester. Students' CDP part 3 entries were then read, coded, and axially coded to find the main categories and themes present in the students' summative reflection on their overall development within the communication competency over the CADE course.

CDP entries were coded until it was determined that thematic saturation was reached for the main categories and themes that erupted from the data during constant comparison of the dataset. Once this coding process was complete, selective coding across all three CDP entries was used to determine the most common themes and categories students discussed within their communication competency development over the CADE course. These themes and their categories were then used to generate theories and propositions that described the interrelationship of the themes and categories to describe student perceptions on communication skill development in the gross anatomy lab context over time.

4.3. Results

Reliability Analyses

A Cronbach's α reliability analysis with an Intraclass Correlation Coefficient (ICC) confidence interval estimate was conducted to measure the internal consistency or reliability of the scale items on each version of the CAT. Cronbach's α and ICC estimates and their 95% confidence intervals were calculated using SPSS version 29.0 based on a 2-way mixed-effects model (Bravo & Potvin, 1991; Koo & Li, 2016). For the CAT-SA-1, the obtained ICC/α value is .897 (indicating good reliability), its 95% confidence interval ranges between .861 and .927, meaning that there is a 95% chance that the true α value lands on any point between .861 and .927. Based on statistical inference, it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li, 2016). For the CAT-SA-2, the obtained ICC/α value is .935 (indicating excellent reliability), its 95% confidence interval ranges between .913 and .954. For the CAT-PA-1, the obtained ICC/α value is .921, its 95% confidence interval ranges between .904 and .935. For the

CAT-PA-2, the obtained ICC/α value is .924, its 95% confidence interval ranges between .908 and .938. Table 4.1 illustrates these results.

Table 4.1

Cronbach's Alpha and ICC results for the CATs

	Cronbach's Alpha	Intraclass Correlation	95% Confidence Interval		N of Items
			Lower Bound	Upper Bound	
CAT-SA-1	.897	.897	.861	.927	14
CAT-SA-2	.935	.935	.913	.954	14
CAT-PA-1	.921	.921	.904	.935	14
CAT-PA-2	.924	.924	.908	.938	14

Scale Items & Statistics

Tables 4.2 and 4.3 illustrate the CAT items and their respective descriptive statistics.

Table 4.2

Item Statistics for CAT-SAs

	CAT-SA-1		CAT-SA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
I greeted my peers in a way that made them feel comfortable.	4.25	.746	4.69	.539	83
I treated my peers with respect.	4.76	.532	4.90	.335	83
I showed interest in my peers' ideas/questions.	4.46	.754	4.72	.525	83
I understood my peers' concerns.	4.42	.767	4.73	.586	83
I paid attention to my peers (looked at them, listened carefully).	4.70	.619	4.82	.446	83

I let my peers talk without interrupting them.	4.55	.720	4.87	.375	83
I gave my peers as much information as they wanted/needed.	4.43	.799	4.66	.630	83
I talked in terms that my peers could understand.	4.46	.786	4.86	.417	83
I checked to be sure my peers understood everything I said.	4.71	.635	4.84	.455	83
I encouraged my peers to ask questions.	4.47	.770	4.72	.591	83
I explained my team's dissection decisions as much as my peers wanted/needed.	4.31	.731	4.71	.615	83
I discussed next steps/any structures that my team did not uncover.	3.95	.961	4.55	.703	83
I showed care and concern for my peers' understanding.	4.88	.425	4.84	.427	83
I spent the right amount of time with my peers.	4.64	.708	4.81	.551	83

Table 4.3

Item Statistics for CAT-PAs

	CAT-PA-1		CAT-PA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
This peer teacher greeted me in a way that makes me feel comfortable.	4.87	.420	4.94	.270	223
This peer teacher treated me with respect.	4.90	.424	4.95	.272	223

This peer teacher shows interest in my ideas/questions.	4.67	.635	4.90	.359	223
This peer teacher understood my main concerns/questions.	4.69	.644	4.90	.383	223
This peer teacher paid attention to me (looked at me, listened carefully).	4.75	.567	4.92	.319	223
This peer teacher let me talk/ask questions without interrupting me.	4.88	.353	4.95	.226	223
This peer teacher gave me as much information as I wanted/needed.	4.58	.806	4.78	.544	223
This peer teacher talked in terms I could understand.	4.75	.657	4.88	.479	223
The peer teacher checked to be sure I understood everything	4.64	.739	4.89	.388	223
This peer teacher encouraged me to ask questions.	4.48	.793	4.82	.488	223
This peer teacher explained their team's decisions as much as I wanted/needed.	4.52	.770	4.75	.583	223
This peer teacher discussed next steps/any structures their team did not uncover.	4.44	.780	4.73	.600	223
This peer teacher showed care and concern.	4.82	.565	4.91	.388	223
This peer teacher spent the right amount of time with me.	4.82	.551	4.93	.368	223

Quantitative: CAT-self-assessment dependent t-test

The CAT-self-assessment was administered at pretest (CAT-SA-1) and sought to measure self-assessed levels of communication skills at the beginning of the semester. The CAT-self-assessment was administered again at posttest (CAT-SA-2) and sought

then to measure self-assessed levels of communication skills at the end of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the CAT-self-assessment was utilized to determine whether change is self-perceived by first-year medical students. A paired samples *t*-test is most appropriate because the data were collected from the same group of students at two different time points (n = 83).

There was a statistically significant increase in CAT-self-assessment scores from Time 1 (M = 4.50, SD = .472) to Time 2 (M = 4.77, SD = .386), t (82) = -5.997, p < .001 (two-tailed). The mean difference in CAT-self-assessment scores was .267 with a 95% confidence interval ranging from -.355 to -.178. Cohen's D, a measure of effect size, showed a small to medium effect (.4053). Tables 4.4-4.6 and Figure 4.1 illustrate these results.

Table 4.4

Paired Samples Statistics for CAT-SAs

	Mean	N	Std. Deviation	Std. Error Mean
CAT-SA-1	4.50	83	.472	.052
CAT-SA-2	4.77	83	.386	.042

Table 4.5

Paired Samples Test for CAT-SAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
CAT-SA-1 to CAT-SA-2	-.26678	.40530	.04449	-.35528	-.17828	-5.997	82	<.001

Table 4.6

Paired Samples Effect Sizes for CAT-SAs

			95% Confidence Interval	
	Cohen's d	Point Estimate	Lower	Upper
CAT-SA-1 - CAT-SA-2	.40530	-.658	-.894	-.419

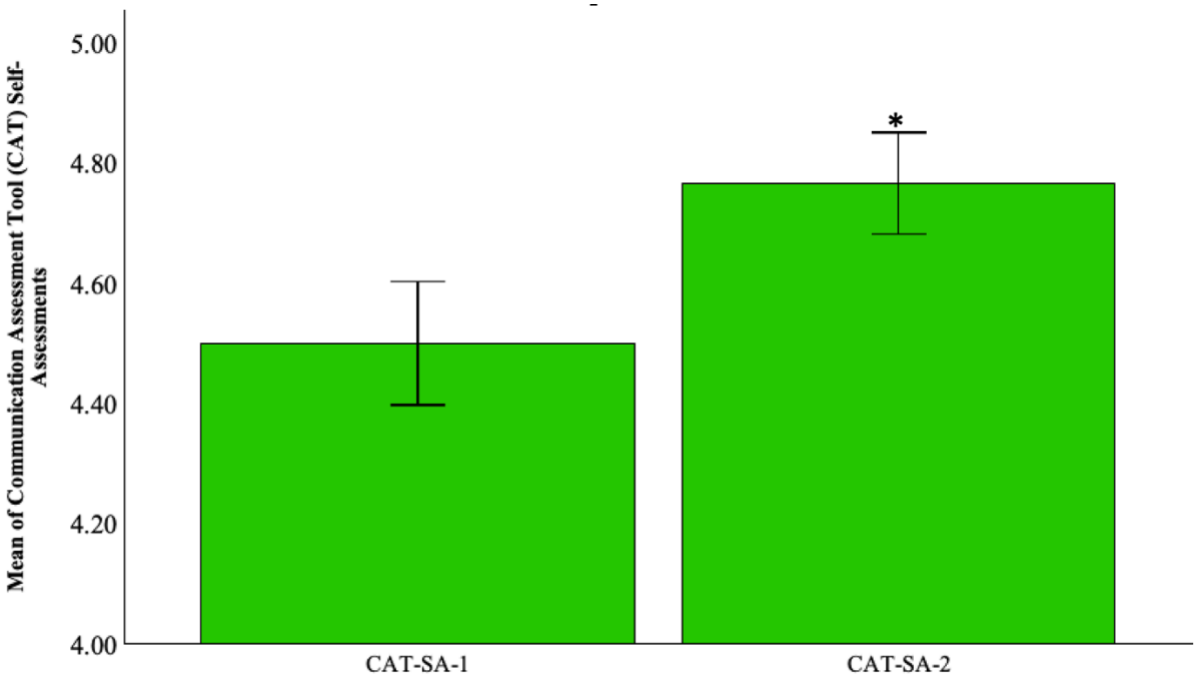

Figure 4.1. Communication Assessment Tool Self-Assessments

Quantitative: CAT-peer-assessment dependent t-test

The CAT-peer-assessment was administered at pretest (CAT-PA-1) and sought to measure levels of communication skills of peers at the beginning of the semester. The CAT-peer-assessment was administered again at posttest (CAT-PA-2) and sought then to measure levels of communication skills of peers at the end of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the CAT-peer-assessment was utilized to determine whether change is peer-perceived by first-year medical students. A

paired samples *t*-test is most appropriate because the data were collected from the same group of students' peer-assessing the same group of students at two different time points (n = 83).

There was a statistically significant increase in CAT-peer-assessment scores from Time 1 (M = 4.70, SD = .331) to Time 2 (M = 4.87, SD = .264), t (82) = -4.976, p < .001 (two-tailed). The mean difference in CAT-peer-assessment scores was .167 with a 95% confidence interval ranging from -.234 to -.100. Cohen's D, a measure of effect size, showed a small effect (.31). Tables 4.7-4.9 and Figure 4.2 illustrate these results.

Table 4.7

Paired Samples Statistics for CAT-PAs

	Mean	N	Std. Deviation	Std. Error Mean
CAT-PA-1	4.70	83	.331	.036
CAT-PA-2	4.87	83	.264	.029

Table 4.8

Paired Samples Test for CAT-PAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
CAT-PA-1 to CAT-PA-2	-.167	.306	.034	-.234	-.100	-4.976	82	<.001

Table 4.9

Paired Samples Effect Sizes for CAT-PAs

			95% Confidence Interval	
	Cohen's d	Point Estimate	Lower	Upper
CAT-PA-1 - CAT-PA-2	.306	-.546	-.775	-.314

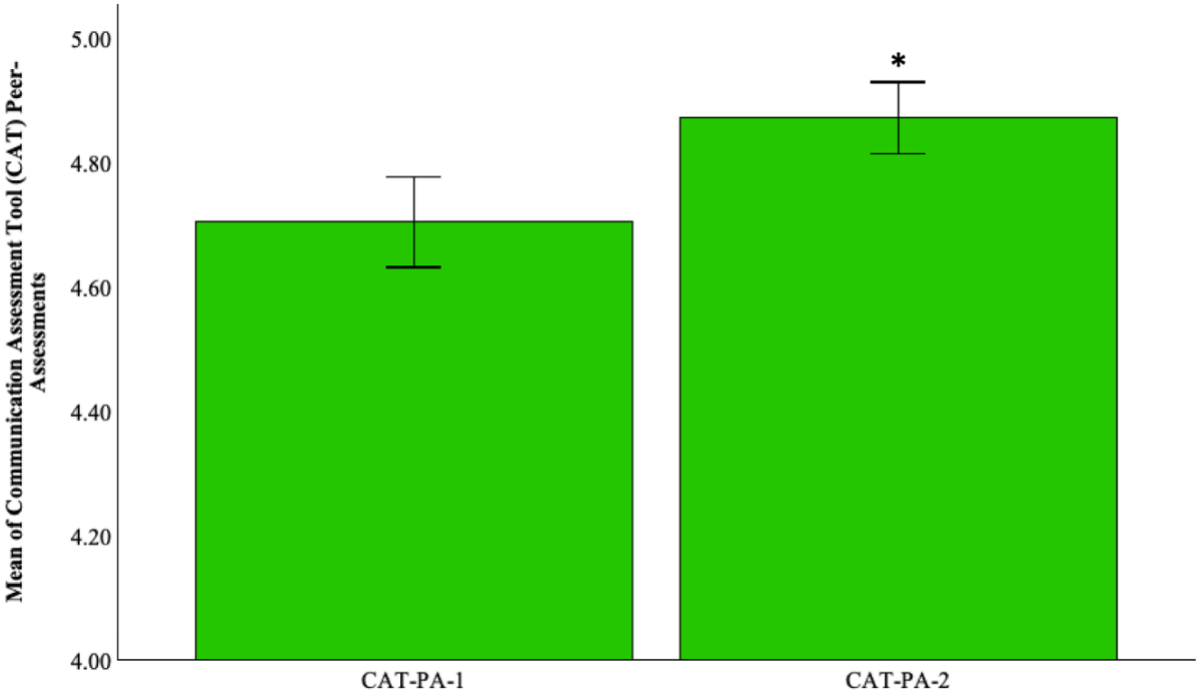

Figure 4.2. Communication Assessment Tool Peer-Assessments

Qualitative Results

Qualitative methodologies of thematic analysis with grounded theory principles were utilized to examine student reflections on their baseline status, progress, and development within the Communication competency during the CADE course. The goal of this analysis was to explore and contextualize the personal strengths and weaknesses and experiences students had whilst developing their communication competency during the CADE course.

Baseline Status and Goal Setting

In CDP part 1, students were asked to reflect on their self-perceived strengths and weaknesses in the communication competency as well as to set SMART goals for improving their communication competency over the CADE course. The major theme of CDP part 1 involved strengths, weaknesses, and goals for the communicative process of Imparting Information, with a specific focus on peer teaching in the gross anatomy laboratory. Students focused heavily on how skilled they were in Imparting Information during peer teaching, including the delivery of information (confidence, clarity, speaking quickly, breaking things down, etc.) and use and understanding of non-verbal behaviors. The most common goals were set around improving aspects of peer teaching in the gross lab. Table 4.10 illustrates main categories and subcategories within the theme of Imparting Information with select excerpt quotes from the dataset to illustrate the creation of these categories.

Table 4.10

Theme: Imparting Information		
Main Category: Peer Teaching Abilities and Goals		
Subcategory:	Strength or Weakness	Related Goals
Delivery of Information		
Clarity	My main area of weakness would be clarity when I am peer teaching. ID9 When teaching about a certain topic in lab, it sometimes leads to more people asking me to clarify what I meant than immediately understanding it. I want my student peers to better understand me when I peer teach ID4 "Some of my strengths in the competency of communication	verifying that my peers have had little to no trouble understanding everything that I have communicated will help clarify that I am being more articulate and clear. ID34 I will generate strategies that helped me understand the dissection and location of structures to communicate more confidently and clearly with my

	include being expressive and clear when I communicate.” ID59 Strength: Clarity ID37 Weakness: teaching with clarity ID99 However, I do believe that I could improve on fluidness when peer teaching. ID17	peers when peer teaching. (Finding a landmark that was super helpful or generating a pneumonic my peers can use!) ID58 I will improve my clarity of speech in the anatomy lab by thoroughly reviewing the structures that we will be learning about that day and memorizing structure names before entering the lab ID71 Better communication by maximizing the use of anatomical terms. For example, instead of gesturing with hand how an incision was made and in what direction relative to the body, I will strive to supplement that with the accurate anatomical terms to further improve clarity. ID37
Speed	I believe a weakness I have is that I speak too quickly when teaching, which I attribute to nerves or fear that I will leave something out that I wanted to say. ID64 Weakness: I believe my ability to peer teach could be improved, by slowing down and going in order more ID152	make sure I remind myself to slow down when talking. ID163 A goal for communication for me would be to be slow down when speaking ID131 My main goal to improve my communication is to slow down both my thinking and speaking ID64
Confidence	One area of weakness I have is confidence when speaking or communicating, especially in regards to teaching my peers.ID158 My weakness in communication revolves around confidence, which makes me more timid even when I have strong opinions. Even if I know the information well, I tend to stutter or be more quiet. ID92 Good at speaking confidently ID147	I want to become more confident in my communication skills with all the new medical terminology that I am learning by practicing in SP Lab, speaking up during PBL Case Scenarios, and vocalizing more in anatomy lab. ID159 I want to be a more clear and confident communicator with my peers. ID38 Initial: have more self-confidence in my skills and

	Areas of strength: - Not afraid to speak up”ID112 One of my weaknesses is to speak up when it is important and needed. ID38 my weakness is sometimes keeping to myself and not sharing my thoughts or ideas as much as I should. ID20	knowledge to teach others. Context: I will speak up when someone asks a question. I think there is a difference between speaking and speaking with confidence and that is something I will work on moving forward. ID44
Subcategory:		
Preparation	After teaching once, I think I need to work on my base knowledge on the topic before teaching it to others. ID76 I also need to be better about memorizing the exact names/pronunciations of structures before entering lab for that particular dissection to facilitate clearer, easier communication with my team members. ID71 My biggest weakness will be related to the content that I am supposed to communicate. I need to make sure that I have prepared in a timely manner so that I can maximize my usefulness to my team and to the other group in my team in anatomy lab. ID122 An area of weakness is not communicating clearly during peer teaching because of not feeling comfortable with the information I am trying to convey. ID157 Strength: preparing thoroughly so that I am able to confidently peer teach effectively and can accurately answer my peer’s questions ID13	To be able to teach better, I need to know the material more thoroughly. Goals are: 1) review and expand on what I am to teach (for me, that will include etymologies or injuries that could help make a structure memorable)” ID157 I will peer teach more comprehensively by anticipating questions my peers should ask in preparation for my assigned day so that I provide my team with a deeper understanding of the material rather than basic locations of structures. ID58 Practicing peer teaching prior to my peer teaching sessions being sure to use the appropriate terminology. ID55 It may help that I prepare a small lecture in advance to help organize my thoughts and word usage. ID4 I can do this by spending more time preparing for lab and looking over the material that way I can better participate in my groups discussion while we dissecting. ID19
Non-verbal behaviors	Strength: I think I am able to recognize people's nonverbal communication well and am able to	I would like to be able to teach the structures without referencing my cheat sheet as often so I'm

	communicate well nonverbally." ID28 Strength: communicate effectively with non verbal- behaviors ID46 Weaknesses: communication through non-verbal behaviors ID10 Sometimes, I feel like my facial expressions can be a bit off or twitchy depending on how stressful the situation is or whats happening around me. ID33 I tend to use my hands in conjunction with my words for things I am excited about or really want to emphasize. I also feel this is a useful aspect of gathering attention when teaching. To properly convey, they must look your way. ID78	able to maintain eye contact and remain engaging. ID60 Make eye contact with each member of the group that I am teaching at least once during my teaching. ID163 Going forward, I would like to present material more clearly and adjust my teaching by being more observant of my peers' non-verbal behaviors.ID10

The second major theme of CDP part 1 involved strengths and weaknesses and goals regarding Gathering of Information. Here, students discussed strengths, weaknesses, and goals regarding listening to others, showing care and concern for others by checking in, and asking questions when unsure. The goals within this theme mainly involved becoming better at listening, checking in with others, and asking questions for clarification or of others during peer teaching interactions. Table 4.11 illustrates the main categories and subcategories within the Gathering of Information theme with a few excerpt quotes from the dataset to illustrate the creation of these categories.

Table 4.11

Theme: Gathering of Information		
Category:		
	Strength or Weakness	Related Goals
Listening	I think my weakness regarding communication can sometimes be active listening. I find myself constructing my responses to my peers in my head prior to them finishing their thought. I do this with the best intention, but they deserve to have my undivided attention while they are speaking. ID16 I do believe one of my strengths is to listen and understand the point of views of everyone involved ID38 An area of strength I believe I have in communication is listening to my audience ID77 An area of weakness I have in communication is active listening. ID75	I will listen to my teammates and ask two follow up questions when they are peer teaching for each peer teaching day. This will improve my listening and communication skills. ID28 A goal of mine is to be a better listener to my team members in and out of the lab by actively listenin ID69 Improve listening skills without interrupting." ID55 To improve my focus in conversations, I will restate the information I receive back to the person I'm talking to. I will practice this in both academic and personal settings this semester. ID14
Subcategory: Interrupting	At times, I interrupt others to share my point ID14 Areas of Weakness: • Listening without Interrupting ID55 A weakness for me in this area would be interrupting. I sometimes get ahead of myself and put in my input even when it's not the appropriate time to do so, which could make my group members feel under-valuedID100 My areas of strength include listening and not interrupting my peers. ID9	My goal is to improve my communication skills by becoming a more active listener. I will do so by refraining myself from interrupting others, and focusing solely on their words as they speak rather than my own thoughts and potential responses regarding those words. ID16 I will make it a priority of mine to actively listen to my lab group, faculty, staff, and peers around me when I am not required to be communicating. ID21
Checking In	An area needing improvement is my ability to check-in on my peers and make sure they are	My SMART goal when it comes to my verbal communication with my team is making sure that

	understanding the dissection. ID125 It is possible that my level of anxiety about doing a good job makes me slightly more likely to forget a point I plan to mention, or neglect to check in for comprehension or questions from my group members as often as I would like. ID78 I think that forgetting to check in while going over everything is a weakness of mine. ID53	I check in with them while peer teaching to see if they have questions or other ideas at least two times during our session. ID53 Check in with my teams after I teach major structures and ask if they have any questions ID9
Asking Questions	Some areas of strength I believe I have is the ability to ask my peers for guidance or about certain things that I am unsure about ID44 I am not afraid to ask questions if I am not fully grasping something in the lab ID117 I also ask clarifying questions once they are done to entice them to continue with their thoughts. I think that is a major strength of mine ID23 My favorite thing to do is ask people questions, which allows me to gain a better understanding about the needs of others. ID114	I will be more open to communicate by asking questions when I am confused ID20 Instead of ordering or saying statements, maybe I should ask questions and engage my peers more. To improve on speaking and listening as part of communication, I will ask clarifying questions or inviting questions in order to hear what my peers have to say. ID35

The third and final theme that emerged in CDP part one was Team Communication. Students discussed that they perceived building rapport with others as a component of the communication competency. They also discussed strengths of affirming others and difficulties with conflict skills. Some students noted how they were non-confrontational and veered away from conflict if it arose while others discussed comfortability with facing and navigating disagreements within teams. Table 4.12

illustrates these categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.12

Theme: Team Communication	
Category:	
Forming Relationships Subcategory: Building Rapport	I have always throughly enjoyed getting to know new people and forming relationships ID16 I believe I am able to get along with people of varying personalities and therefore it is easy for me to establish relationships with all group members. These relationships make it easy for both my peers and myself to feel comfortable when communicating and setting group dynamics and expectations. ID76 I have a strong rapport with my teammates and feel that we are all comfortable speaking to and working with each other. ID71 I believe I have strength in building a rapport with my lab mates ID61 I believe one of my strengths is my ability to relate to my peers. I think communication is key in succeeding as a team, so I really try to find common ground between myself and my team members.ID69
Affirming Others	One of my strengths is in making others feel welcome and empowered to share their perspectives. ID71 my greatest strength is making other people feel understood ID125 Strength: I do a good job affirming peers ID
Conflict Skills	When a teammate is spending too much time dissecting for example, I should be able to respectively chime in and ask if I can try a certain area. A more assertive communication would need to be utilized to achieve this goal. I will know that I succeeded if there is equal time with the cadaver. ID3 Weakness: I do not like confronting people or telling people that they are wrong because I don't want to hurt their feelings, even if that means that I am uncomfortable. ID28 As a people-pleaser, sometimes I would prefer to have cohesiveness instead of rocking the boat. ID22

	One of my weaknesses is being able to navigate any potential conflict." ID69 Weakness: Setting boundaries and communicating when there is an issue that needs to be addressed. I tend to avoid conflict/any situations in which difficult conversations could arise ID148 I think an area I lack is possibly giving constructive criticism. I am a non-confrontational person and don't want people to get offended when I give criticism and so then sometimes I choose not to communicate that. ID66

Progress

In CDP part two, students were asked to reflect on their initial progress in their communication competency goals set earlier in the semester in CDP part one and to revise/set new goals for the remainder of the CADE course. Here, students mainly reflected upon their progression toward their goals, whether or not they intentionally worked toward their set goals, and their positive feelings toward the formative feedback they received on their communication competency prior to completing the CDP part two assignment. Goals that were set or revised in this CDP entry mainly regarded Imparting Information (improving peer teaching), Team dynamics (strengthening team communication) and Gathering of Information (improving listening).

The first theme of CDP part two involved progression toward goal(s). Here students discussed whether they had intentionally worked toward the goal they set at the beginning of the semester and if they still had room to grow within the competency. Specifically, students elaborated on how practicing preparedness enabled more confidence during peer teaching and therefore a belief of improved communication skills since the last CDP entry. Table 4.13 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.13

Theme: Progression toward Goals	
Categories:	
Room to Grow	I have done a good job of communicating but also still have room for improvement, particularly regarding my peer teaching of Group A dissections to Group B members. ID77 I have worked on this competency, but not to the extent I would like. I was not surprised at my feedback, but I believe there is still room to grow here, and that I need to actively remind myself to ask for clarification more ID14 I appreciated the feedback I received from my teammates and feel as if I can continue to improve my communication and teaching skills throughout the remainder of the semester. ID76
Actively worked toward goal(s)	I have intentionally worked on improving my communication by fostering more communication between my lab group through the development of a group chat, and being more intentional on how I communicate because everyone interprets and comprehends things differently. ID85 I have intentionally worked toward my goals and tried my best to have better interpersonal communication among our team as we became closer friends. ID46 I have been working on my communication goal by speaking up more frequently and with more confidence during our application exercises and asking more questions from our instructors during dissections ID13 I worked extremely hard to be the type of communicator that my goal set out to be and it has paid off through my team's efficiency and communication skills we have with each other. ID66 I think creating SMART goals was helpful in holding myself accountable to personal development. ID23
Subcategory: Peer teaching	I have actively worked during my peer teaching to ask questions of Group B, have them demonstrate the dissection back to me after I peer teach, and ask throughout my teaching if they have any questions ID55 I also feel like my peer teaching has been stronger since the first CDP, because I have taken the time to write good notes right after the lab, which I then use to guide what I tell group B. ID71
Subcategory: Preparedness	I do feel as if I have continued to improve the quality of my teaching throughout the semester and have noticed that I am much more confident with explaining the material when I have spent time with it prior to lab ID76

	I have worked on preparedness for peer teaching by coming into the lab for longer amounts of time preceding peer teaching and studying the class content for that lab more closely. ID52 I have made a sincere effort to be better prepared for lab and to be more engaged. ID60 Because I have made an intentional effort to come to lab outside of scheduled lab time, I have gotten more comfortable with our anatomical donors and my initial apprehension has melted away. This improvement translated into peer teaching because now I was more comfortable talking about the different structures in/on our donors. ID9
Subcategory: Confidence	I feel like the more comfortable I got with studying lecture materials relevant to labs, and just dissections in general, the more comfortable I got when it came to peer teaching and getting rid of those nerves. ID61 I have allowed myself to develop confidence in my ability to answer questions and help guide others towards a mutual success…when our zone instructor comes to our group, I am more confident in my answers and I am also okay with being wrong and making a mistake--that is all included in the process of learning and being human! ID44 By the time of peer teaching, I have been able to consistently answer practice problems correctly, so I am confident in the material. As a result, I believe that I have been better able to answer Group A's questions. ID52 I have also worked on being more upfront and willing to speak up while maintaining a positive demeanor ID27

Another theme from CDP part 2 involved students' positive and unsurprised feelings toward feedback. The majority of students reported that they had positive, or agreeable thoughts toward the formative feedback they received mid-semester, and that they were unsurprised by the feedback, while very few students mentioned if they were disappointed or surprised with the feedback received. Table 4.14 illustrates excerpts from the dataset to demonstrate this theme.

Table 4.14

Theme: Positivity toward Feedback	
Category:	
Not surprised	My communication skills feedback was higher than I expected, so I'm glad my labmates think I can be helpful! ID60 I appreciated the feedback I received from my teammates and feel as if I can continue to improve my communication and teaching skills throughout the remainder of the semester. ID76 I received positive responses in this competency which I was happy to see and I feel is appropriate for the level of effort I put into being prepared for the labs I am responsible for teaching. ID78 I was not surprised on my communication skills feedback thus far because I worked to the best of my ability to foster an active learning experience for my peers while teaching them structures on the dissections I performed ID61 I was happy to see the formative feedback results for this competency and will continue to improve this skill. ID20

A few themes recurred from CDP part one in CDP part two as students revised/set new goals for the remainder of the semester. The Imparting Information and Gathering of Information themes appeared again as students discussed goals within these themes mainly related to improving peer teaching. Students mentioned improving clarity and slowing pace while teaching and mentioned strategies for improving peer teaching like practicing ahead of time and checking in on others' understanding. Students also set new goals regarding improving listening skills within the Gathering Information theme. Table 4.15 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.15

Theme: Imparting Information	
Category: Improve Peer teaching	
Excerpts	Extrapolated Strategies
Plan: When I come in to review anatomy prior to my peer teaching sessions, I will rehearse, out-loud, how I will teach during my session ID70 I want to work on my peer teaching skills after dissections so that I can walk Group B members through the steps of the dissection and rely less on looking at the checklists to point out structures as I have done. ID77 New Goal for Communication: Practice my peer teaching to the point of it being streamlined each time that I must peer teach. This will allow for more time for my peers to practice naming structures/relationships and stop after every 3-5 structures to ask for questions. ID55 I want to ensure that my teaching is coming across affectively when I am showing the other group a lab they are unfamiliar with. An aspect of this is making sure I have a thorough understanding of the content myself and am confident when presenting it. I plan to spend at least 3 hours in lab outside of class time per week to ensure I understand the content ID78	Practice/Prepare
Theme: Gathering of Information	
Category: Improve Peer teaching	
For the remainder of the semester, I will work on improving my peer teaching. I feel as though I have improved when listening to others peer teach, but I could improve the quality of my peer teaching by ensuring that others actually understand what I am teaching. ID28 I want to ensure the group's understanding of the material, so as we talk through structures I may not only ask them to fill in the blanks but also connect lecture with lab and discuss secondary questions as well, such as the functions, attachments, and origins of structures. ID77 When teaching, I will check with each person individually at least 3 times to ensure my attempts to communicate the content are working effectively ID78 I am revising my goal to pause and ask if there are any questions after going over each large step from the lab guide	Check on others' understanding: Ask Questions Quiz Teach back

instead of aiming for pausing at least twice while peer teaching. ID53 I would like to be a stronger teacher to my peers. I want to ask more questions, "pimping" friends in the lab to help reinforce our learning of the material…I would like to have peers "teach back" the material, as I find that helpful when others are teaching me. ID60 Building on these goals, I believe I could improve my lab skills as a whole if I was able to better communicate and effectively ask secondary questions to my peers, or just questions in general. ID61 My main goal for the remainder of this semester is to focus on encouraging questions as I go during my peer teaching instead of waiting until the end to ask if anyone has questions. ID27	
Category: Improve Listening	
I still am trying to be a better communicator and based on formative feedback and my personal goals I plan to improve my communication by actively listening to my fellow teammates ID46 My new goal for improving my competency regarding communication is to facilitate constructive conversation in addition to actively listening to my teammates responses. I think I've done a good job in improving my ability to actively listen to them when they speak, but now I want to take that a step forward by initiating those conversations by asking them more often how they feel about lab and their opinions on how we can improve both individually and collectively. I want to facilitate these conversations, giving myself more opportunities to practice the active listening skills I originally set for myself towards the beginning of the semester! ID16 One new aspect of communication that I could get better at would be listening. Sometimes I catch myself over speaking out of excitement and may not be letting others talk as much as they deserve. To fix this issue i'll start making a conscious effort to hold back my thoughts to a question and let other team members communicate first. ID81 Over the next 6 weeks (by 12/20), I will be more intention towards being a better listeners to my peers. ID18 My new goal is to improve my listening skills. I want to work on phrasing questions that build off what the person is saying instead of having a question in my mind that I want to say ID33	

The Team Communication theme appeared again with students discussing increased comfortability with communicating with their teammates and peers but also goals related to strengthening team communication. Asking teammates questions and giving teammates support were seen as important aspects to strengthening team

communication. Several students discussed that they had developed stronger communication skills with their teammates, and a few shifting the focus of individual communication skills to how their team communication as a whole had improved since CDP part one. Table 4.16 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.16

Theme: Team communication	
Category: strengthen team communication in lab	
Excerpts	Extrapolated Strategies
My new SMART goal for the remainder of the semester is to make sure that I ask my teammates what questions they have about the anatomy we will be looking at before we start the dissection (things that may be confusing from lecture or the lab guide) and then follow up at the end of the dissection to make sure that we had all of our questions answered ID71 My teammates are always willing to help and I want to utilize their expertise by being a better communicator of my questions as soon as they come up. I am now more comfortable with them to ask questions more frequently and look forward to aiming for this goal! ID58 Sometimes I know what I want to ask but I do not know how to go about asking it. I believe this will be attained through more practice at communicating with my peers and interacting with them during dissections ID61 I will make an effort to ask my group members advice when I am struggling with lab identification ID22	Be comfortable asking teammates questions
For the remainder of the semester, I hope to improve my communication abilities by being more vocal and providing positive support for my lab teammates. ID10 I would like to do a better job of intervening when I think I can be helpful and letting my team members know that I am aware that they are struggling. For example, during the SMA dissection, a fellow group member and I noticed that another group member was becoming hyperfocused on a particular area, so we offered to switch with them to maintain perspective. This was successful, so I would like to do so more often. ID52	Provide support/encouragement

“I will reach out to my lab members to make sure they are not feeling overwhelmed and to offer any help I am capable of providing. ID74	
Category: developed stronger communicative relationships with team	
I have tried to give my dissection teammates my undivided attention and actively listen to their options and perspectives with open ears and an open mind. ID16 I have intentionally worked on improving my communication by fostering more communication between my lab group through the development of a group chat, and being more intentional on how I communicate because everyone interprets and comprehends things differently. ID85 I believe that I have become a stronger communicator, speaking more freely with my dissection team and speaking up more when I felt like someone else might be confused on a topic that I understood or, vice versa, when I would like for one of my teammates to help explain something about the anatomy that I have not yet grasped. ID71 I have been more open with my lab group and have expressed my thoughts and opinions more often compared to the beginning of the semester. ID20 my group members and I have gotten to know each other well enough to know how we each learn and communicate. ID19 We discuss what task each of us will be responsible for that day, such as lead dissector, assistant dissector, and guide person/osteology learner for the day. We have all agreed to show up to lab 10 minutes early to get everything set up and sometimes even begin peer teaching early. ID31	

Development

In CDP part three, students were asked to give a summative reflection on their overall development within the communication competency throughout the CADE course (from August-December) as well as to discuss how they will continuously maintain/improve skills in this competency as it relates to the medical field moving forward. Here, students mainly discussed their belief of improved communication skills throughout the semester, positivity toward the feedback they received, and how communication helped them establish good relationships with their teams. They then focused on how important communication is to the medical field and maintenance of the competency moving forward.

The first major theme of CDP part three was the belief of improved communication skills over the CADE course. Most students mentioned a general belief of improved communication skills from the beginning of the semester. Many students, however, gave specific information as to why they believed they improved their communication over the semester, especially due to improving aspects of peer teaching. Students mentioned they had become better at asking and answering questions, improved their listening to peers and teammates, and improved peer teaching due to preparedness and increased confidence. Table 4.17 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.17

Theme: Belief of Improved Communication Skills	
Category:	
Within the Theme: Imparting Information Subcategory: Improved Peer Teaching	I have been able to refocus my teaching efforts in lab to helping my peers remember and recognize structures and their relationships rather than simply going down the list and pointing them out like I probably did on my first day of peer teaching ID77 For peer teaching, I improved on this during the course of the semester by practicing my sessions before lab days. ID70 I also feel that I have improved in my ability to effectively communicate my thoughts and teach what I have learned to my teammates. ID27 I feel like I have improved my communication skills a lot this semester, especially when it comes to peer teaching ID53 With each opportunity to peer teach, I thought that I did a better job of sharing the information I learned in lab. In particular, I started to share useful tips for remembering spatial relationships on anatomical donors by emphasizing which structures can be found together.ID52 My peers have been able to recap what I have taught including tricks to remember things, which I take as a measurement of my success in communicating during teaching ID77
Subcategory: Improved confidence	I believe this is a huge improvement since the start of the semester, because I was able to help foster an active learning environment for

	my classmates by being confident and knowledgeable about the material and making sure they understood before moving on, especially when peer teaching. ID61 I have gained confidence in myself to articulate my thoughts in a professional and efficient manner. ID35 As the semester went on and I got to know my lab-mates better, I became more confident, and communicating didn't become as much as a task or something I spent excessive amounts of time thinking about before actually conducting ID85 I have felt more confident in asking questions or taking a lead in giving guidance. ID44 I feel much more confident in my ability to explain concepts to my peers and check in with them while peer teaching to see if they have any questions ID53
Improved use of anatomical terms	I believe that my communication about anatomy topics got much better as the semester progressed. I learned how to organize my thoughts and use anatomic relationships to explain my questions/reasoning ID71 When asked a question before, I would use nonspecific language (ex. I think its here because this is up higher and kind of behind this). Throughout the semester, I have learned that not everyone sees things the way I do, and not everyone can understand nonspecific language, specifically in lab. I have tried to be more specific when describing structures by using anatomical terms (ex. superior and posterior) because that is something that we all should know and can reference. ID28 In the beginning of the semester, I had a really hard time consistently using terms like superior or lateral to instead of above or beside. Now, I find myself using these terms in conversations during study sessions with my peers. The amount of times that I needed to stop and correct myself during lab decreased and I even transferred that improvement into other setting outside of lab. This shows that I am getting more comfortable with using these terms because I am easily incorporating them into dialogue during a more relaxed setting. ID9 I have learned a lot about how I naturally communicate, allowing me to focus on my natural weak spots. I've definitely improved my ability to speak about anatomy. Terms that felt clumsy during block one (anterior, posterior, deep, superficial, etc.) now roll off the tongue, which feels cool. ID60 I can now comfortably use the appropriate anatomic terms to describe structures and their positions relative to others. ID37

Within the Theme: Gathering of Information Subcategory: Improved ability to ask/answer questions and check in with others	I believe one of my biggest improvements to communication, since August, is asking follow up questions to make sure my classmates understand what I'm trying to convey during peer teaching. ID74 In Block 5, I managed to stay on top of all the lecture material while also frequenting the lab "after-hours." Because of this I was able to ask my classmates meaningful secondary questions to better help their understanding of pertinent anatomical relationships and structures. ID61 I learned how to articulate questions in a meaningful way and how to communicate my own needs with others in a timely manner ID58 I'm much better at checking in with classmates and ensuring they're following me and don't have any questions. ID60
Subcategory: Improved Listening	I have certainly become much better at listening, asking questions, and talking with my lab group. ID75 I feel that I've done a much better job of listening to my teammates and answering their questions. ID14 Overall, I feel I have achieved my initial goal of becoming a more active listener. I have spent my time in lab asking more questions to my peers about their progress, their understanding, and their opinions about the efficacy and time management of our dissections. ID16 On CDP part one, i developed a goal to begin actively listening, a goal which I believe has been accomplished by forcing myself to attend in-person lectures and by prompting my peers to ask questions during peer teachings. ID21

The second major theme present in CDP part three was Team Communication and the belief that communication skills improved due to establishing good relationships with teammates. Students discussed how they believed their communication with their teammates had improved, as well as how their team's communication as a whole had improved over the CADE course. Table 4.18 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.18

Theme: Team Communication	
Category:	
Learned effective team communication	when we first started it was a challenge to keep up with everything while communicating with my team to be able to cover all the content. However, after 4 months I became familiar with our team dynamics and deliberately worked toward my effective communication among our team members. By effective communication we were able to cover more complicated subjects in a timely manner. ID46 I also feel like I have improved in my ability to communicate with my team while dissecting and working in group settings. ID53 Since August I have learned how to effectively communicate with members of my team while working in lab. ID69 My teammates have provided me with feedback throughout the semester and we have worked together to find the best ways we all communicate with one another. ID19 I learned how to articulate questions in a meaningful way and how to communicate my own needs with others in a timely manner while anticipating the needs of my peers. ID 58
Established relationships	I believe, as is evidenced in my in my 2nd CDP feedback, that I have improved in my communication skills over the course of this semester. I think the vast majority of this improvement can be attributed to growing closer and more comfortable with my dissection team…They have done a wonderful job creating an environment in which I feel safe and open to discussing any feelings, issues, or items of concern I may have with them. ID16 Since August, I've grown in comfortability in communicating with my peers as I got to know them better ID85 As a Lab group, we have gotten to know each other better, including our strengths and weaknesses." ID22 I have improved my communication competency skill by establishing good relationships with my team members and knowing my teammates' strengths and weaknesses ID20

Another theme that was present in CDP part three was students' feelings toward feedback. Students were generally pleased with the feedback they received and unsurprised by it. Many mentioned how gratifying it was for others (peers, faculty) to see

their efforts in trying to improve their communication skills and have that reflected in the informal and summative feedback received. A few students also mentioned an increased willingness to give and receive feedback. Table 4.19 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.19

Theme: Feelings toward Feedback	
Category:	
Positive Subcategory: Not surprised	My formative feedback was overwhelmingly positive and this mirrors my own feelings about my communication this semester. ID78 Overall, I feel that I have put in the necessary work to allow my communication with my peers to significantly improve, so I was not too surprised to see that my formative feedback was in agreement with this. ID13 I was not surprised by the formative feedback I received. I felt that I have been doing a good job peer teaching and the formative feedback reflected that. ID47 I think that my results from the progress and feedback reflects that I have actually grown in this competency. ID34
Others see my efforts	I think my formative feedback I have received from my peers reflects this improvement. ID76 I started to share useful tips for remembering spatial relationships on anatomical donors by emphasizing which structures can be found together. I think my peers appreciated this slight change in style, and the increase in my communication feedback score reflected that. ID52 I feel much more confident in my ability to explain concepts to my peers and check in with them while peer teaching to see if they have any questions, and I was happy to see that my formative feedback showed this too. ID53

The final theme of CDP part three was maintenance of the communication competency and its importance to the medical field. Students acknowledged the importance of communication skills as future physicians and how they will take what

they've learned about the communication competency during the CADE course into the medical field. Students also discussed how reflecting and asking for feedback were the two main strategies for maintaining the communication competency as they move into the medical field. Table 4.20 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 4.20

Theme: Maintenance of and Importance of Communication in Medical Field	
Category:	
Feedback and Reflection	feedback is one of the best ways for evaluation and I will rely heavily on feedback to ensure my competency. ID46 I will also make sure to listen to others' feedback ID4 I believe that the only way to get better at this is to practice. One thing that has helped me thus far is practicing teaching with my friends and asking for their feedback. ID27 I will ask for feedback to ensure that my communication skills are exceptional and ask for any suggestions for improvement. ID47 The best way for me to continue to work on my communication skills in this respect is for me to receive and reflect on the feedback I am given ID19 I will take time to reflect on my growths and determine how I can improve more as a communicator and physcisian ID10 In terms of moving forward, I will maintain and keep the skill sets that I have developed with me. I will also reflect on the areas of weakness/improvements and continually strive to get better. I am a big believer in learning more from failures and mistakes than being right 100% of the time. ID44
Take what I have learned forward	I will use what I have learned about communicating in a group frequently when it comes to the medical field. I plan to continue trying to improve in this competency by working with my peers to talk through what we are learning in our classes or when talking about other things I may have seen during shadowing or different meetings. I know in the future I will use these skills when trying to explain medical concepts to patients or explaining different conditions or cases when working with a healthcare team. ID53 I did a good job of bringing the team together and focusing on a collective goal. I will use these experiences in my professional life by thinking back to lab and the power of a well communicating team. ID23

	I have learned that I really like teaching and plan on applying the skills I've gained in communication throughout my medical career ID77 I will take what I have learned in CADE about communication to form meaningful relationships as I continue to grow as a medical professional. This includes asking for help from colleagues when I need further clarification or tips on techniques to best help a patient. ID31
Importance of Communication as a medical professional	As a medical professional, communication is at the top of the list of important skills. By starting to enhance my skills now, I hope I am very equipped to anticipate my patient's questions and have them answered in a respectful, compassionate way. ID58 As a practicing physician, communication is essential. If you can't adequately let your patients know what's happening, you're not doing your job. ID60 The communication skills necessary for the completion of the medical school didactic years varies drastically from those needed in clinical years; therefore, as clinical years approach and I find myself in the presence of patients, I will be sure to both carefully listen and conclude each encounter by giving the patients the opportunity to discuss thoughts, questions, and concerns. ID21 By sticking with the basics of communication (eye contact, listening for understanding, and using concise messages), I plan to do my best to make sure all of my patients are heard and their needs are met. ID14 This is important because we will be expected to build connections with our patients and establish a line of communication in order to provide the best care possible. ID50 I think that these skills were important for me to expand upon because as we continue with our medical education, we will be making more connections and be in new situations in which we will have to communicate effectively and efficiently. ID34

Overall, three main themes emerged longitudinally across the students' Communication CDPs: Imparting Information, Gathering of Information, and Team Communication. These themes and their prominent subthemes are depicted in Figure 4.3.

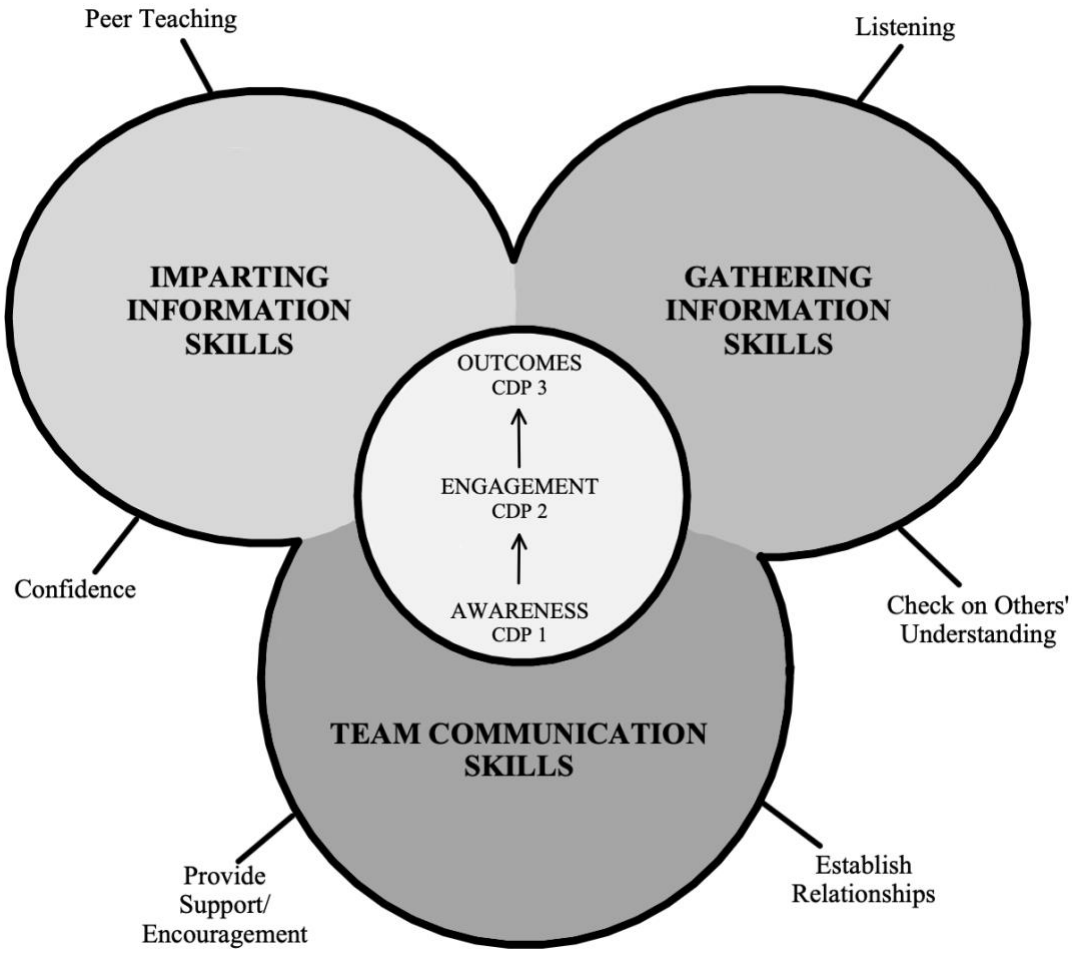

Figure 4.3. Communication Competency Development Themes and Subthemes

4.4. Discussion

This study used three separate methods: quantitative self-assessments and peer-assessments, and qualitative longitudinal portfolio pieces, to investigate communication competency development of first-year medical students in the gross anatomy lab context over time. The quantitative results indicated that first-year medical students at ULSOM self-assess communication skills at a very high level. Based on evaluation standards of Likert scales outlined by Genc in 2023, a high level is defined as a rating between 3.40-4.19 and ratings between 4.20 and 5.00 are defined as very high (Said, 2023). The students also exhibited statistically significant self-assessed communication growth from

the beginning of the semester to the end of the semester (Table 4.4 and 4.5). The quantitative results also indicated that students assess their peers at a very high level (>4.7) (Said, 2023), and that students perceived that their peers had increased their skills over the course of the semester (Table 4.7 and 4.8). The qualitative results revealed three main themes that coursed throughout all three parts of the CDP: Imparting Information, Gathering of Information, and Team Communication. These themes involved many skills within the communication competency that students had strengths and weaknesses within and set goals for improving throughout the semester.

For students who discussed aspects of Imparting Information, at the beginning of the semester there was a focus on how their strengths and weaknesses in speed, clarity, and confidence affect the delivery of information whilst peer teaching. Several students expressed an awareness of talking too fast while they teach and needing to slow down while speaking, and others noted that using proper anatomic language while teaching will result in improved clarity (Table 4.10). Many students also discussed how confidence affects their ability to teach, noting that teaching peers and speaking up when needed can be difficult. These students discussed a desire to improve self-confidence by practicing speaking up when they have questions or concerns and bettering their use and understanding of anatomical terms (Table 4.10). Students also noted how being prepared or not being prepared for lab and or peer teaching affects their communication skills. One student described how preparing enabled confidence to teach effectively and created the ability to accurately answer their peers' questions (Table 4.10). More often, students noted how not knowing the content ahead of peer teaching was a weakness and set goals to be better prepared for lab so that their thoughts could be organized, that they could

have a deeper understanding of the material and participate more fluidly in group discussions during dissection. Students also recognized non-verbal behaviors as being an aspect of the communication competency, with many stating they were good at using both verbal and non-verbal cues while communicating and discussed how using and maintaining eye contact is a way to engage with others during peer teaching. This aspect of communication was mainly only discussed as a strength and weakness, and students did not tend to reflect on non-verbal behaviors as they moved forward in their CDP.

For students who set goals for improving peer teaching, at mid-semester many students reflected on how they had worked on improving their preparedness by rehearsing explanations ahead of time, taking notes to create a teaching guide, and spending more time in the lab studying prior to peer teaching. Becoming more comfortable with the content and the anatomy lab in general also resulted in increased confidence and better explanations of material while teaching (Table 4.13). Some students still had goals to set for improving peer teaching, and these students also focused on practicing and preparing for peer teaching ahead of time as their strategies for improving their teaching skills (Table 4.15). By the end of the semester, these students discussed their belief of improving their communication skills by improving their peer teaching, confidence, and use of anatomic terminology over the course of the semester. Several students noted how they figured out ways to help their peers better understand the information they were teaching through sharing tips and tricks for memorization and sharing those with their peers (Table 4.17). They also noted that increasing comfortability with anatomical terms and using them accurately enhanced their comfortability in discussions in lab and while peer teaching. By preparing and being knowledgeable about

the material, students noted how this increased confidence over the semester and resulted in an ability to articulate thoughts more clearly (Table 4.17).

For students who discussed aspects within the Gathering Information theme, at the beginning of the semester there was a focus on listening skills, checking in with others, and asking questions. Within this theme, listening was the most stated weakness and strength amongst the students. For students who saw it as a weakness, they created goals for improving their skills like asking follow-up questions when others are peer teaching, restating information back to the person they are talking to, refraining from interrupting others when they speak, and trying to actively listen to others (Table 4.11). Some students focused on a weakness of not checking in with others when needed and needing to improve this during peer teaching to ensure they're understanding the material, while others stated that asking questions of others was a strength. For the students who struggled with asking questions and checking in, asking clarifying questions of others and being more open to asking questions when confused were common goals set to improve this aspect of gathering information (Table 4.11).

By mid-semester, some students reflected upon how they believed they had already improved their listening skills and checking in with others, but mainly students created new goals or revised their goals for improving listening and checking in on others' understanding while they peer teach for the remainder of the semester. The students that had a desire to improve their listening skills over the remainder of the semester wanted to facilitate more constructive conversations, allow others to speak their thoughts first and build off of what others say rather than already having a planned question or thought to say (Table 4.15). Many students indicated wanting to be a better

peer teacher by asking more questions of their peers while they peer teach, checking in and ensuring that they are understanding the material as they teach it, quizzing and even having the students teach the material back to them. Ensuring others' understanding was a common reason for wanting to improve peer teaching (Table 4.15).

At the end of the semester, students noted how they believed they had improved their ability to ask and answer questions and check in with others. Students noted that they improved in how to frame questions and asking follow-up questions to make sure their peers understood what they taught (Table 4.17). Some students noted being "much better" at- and believing "one of my biggest improvements to communication" is- asking follow-up questions and checking in with others' understanding during peer teaching. Others noted how they had become "much better" at listening to others and achieved their goals of becoming more active listeners (Table 4.17).

The final theme that transcended all three parts of the CDP was team communication. These students discussed at the beginning of the semester how they had strengths within forming relationships, building rapport, and affirming others. Noting how getting along with people of varying personalities and figuring out ways to relate to others is key to succeeding in a team. Students mentioned strengths in making others feel understood, affirmed, welcomed, and empowered (Table 4.12). Where students mentioned weaknesses within this theme was with conflict skills. Students here discussed having difficulty with navigating conflict, communicating when there is an issue, dealing with hard conversations, setting boundaries, and giving criticism (Table 4.12). These students acknowledged being non-confrontational and preferring cohesion and not

wanting to offend or hurt others' feelings, which results in a lack of communication of needs.

By mid-semester, several of these students were reflecting on how they had developed stronger relationships with their dissection teams as the semester progressed, and how that contributed to becoming stronger at communication. With students expressing how they had been more open with their lab group since the start of the semester, sharing more thoughts and opinions, actively listening to their perspectives, and creating group chats for more intentional communication outside of the lab (Table 4.16). There were also students who acknowledged the need to strengthen their team communication in the lab setting for the remainder of the semester by becoming more comfortable asking their teammates questions and providing more support and encouragement in the lab setting. Utilizing teammates expertise, interacting with teammates during dissections, providing positive support, and asking for advice during dissections were some of the goals mentioned for strengthening their dissection teams' communication.

At the end of the semester, these students had determined they learned how to effectively communicate with their lab team members and that establishing relationships with their team helped improve their communication skills. A general feeling of improved ability to communicate while working with their teams in the lab was noted, with some recognizing that developing more effective communication allowed their teams to cover more complicated content effectively (Table 4.18). Growing closer and more comfortable with teammates and getting to know each other better were attributed

as some students reasoning for improving their overall communication skills in the gross anatomy lab context.

While many themes and categories were discussed in the students' CDPs, the overarching aspects that were expressed frequently and longitudinally across each CDP were peer teaching abilities and team communication skills. Students utilized peer teaching as their mechanism for improving their abilities to impart information to others. In the gross anatomy lab context, we suggest that peer teaching is therefore a critical component to helping first-year medical students learn about, reflect upon, and develop important communication skills as they move forward in their medical education and profession. Peer teaching enabled students to work on their pace of delivering information, ability to ask questions, speaking clearly and with appropriate anatomic language, and adequately preparing ahead of time in order to teach others well.

These results from the quantitative and qualitative methods were triangulated to determine if convergence occurred or if discrepancies were observed between data sets. Methodological triangulation was useful and necessary to address multiple aspects of the same phenomenon--communication competency development over time in the gross anatomy lab context. This triangulation aimed to address the following questions:

- Do first-year medical students exhibit growth over time? If so, how? If not, why? (*Quantitative results + Qualitative results/discussion)*
- What skills do students already possess in this competency, what skills did they believe they gained or improved upon? (*Qualitative results/discussion)*

- How do students feel about their progression in the competency? (*Qualitative results/discussion)*

The quantitative assessments provided static snapshots of students' behavioral communication skills and the opportunity to determine if growth was self- and/or peer-perceived, while the open-ended qualitative portfolio entries furnished the opportunity for longitudinal exploration of student perspectives on their progression through behavioral attributes of communication in the gross anatomy lab context.

The quantitative aspect of this study demonstrated that first-year medical students at the ULSOM did exhibit statistically significant growth from CAT-SA-1 to CAT-SA-2 ($p < .001$) and CAT-PA-1 to CAT-PA-2 ($p < .001$). These findings converge with the qualitative results in that students discussed a belief of improved communication skills over the course of the semester. Students discussed in their CDPs how they progressed in skills involving Imparting Information such as improving peer teaching techniques, preparation for teaching, and their use of anatomic terminology while communicating, and how developing those skills increased confidence. This improvement was demonstrated within the quantitative results where items involving Imparting Information saw increases from the beginning of the semester to the end of the semester. In the CAT-SAs, Imparting Information items such as "I gave my peers as much information as needed" ($M = 4.43$ to $M = 4.66$), "I explained my team's dissection decisions" ($M = 4.31$ to $M = 4.71$), and" I talked in terms my peers could understand" ($M = 4.46$ to $M = 4.86$) all demonstrated self-assessed growth. Students also perceived their peers to have increased these skills on the CAT-PAs: "this peer teacher gave me as much information as I needed" ($M = 4.58$ to $M = 4.78$), "this peer teacher explained their team's dissection

decisions" (M = 4.52 to M = 4.75), and "this peer teacher talked in terms I could understand" (M = 4.75 to M = 4.88) all demonstrated peer-perceived growth.

Students also discussed in their CDPs how over the course of the semester they believed they had improved their abilities to listen actively to their peers and not interrupt them and check in on others' understanding of material by asking questions. These aspects of gathering information were also evaluated on the CAT, and students demonstrated self-perceived growth within these items: "I paid attention to my peers (looked at them, listened carefully)" (M = 4.70 to M = 4.82), "I checked to be sure my peers understood everything I said" (M = 4.71 to M = 4.84), and "I encouraged my peers to ask questions" (M = 4.47 to M = 4.72). Students also perceived their peers to have increased these skills on the CAT-PAs: "this peer teacher paid attention to me (looked at me, listened carefully)" (M = 4.75 to M = 4.92), "this peer teacher checked to be sure I understood everything they taught" (M = 4.64 to M = 4.89), and "this peer teacher encouraged me to ask questions" (M = 4.48 to M = 4.82).

An aspect of communication that was discussed in student CDPs but not assessed by the CAT was team communication. Students indicated they learned how to effectively communicate with their dissection team members over time and that establishing these relationships contributed to better communication skills.

Of note, every item on the CAT-PA demonstrated an increase from the beginning of the semester to the end of the semester, indicating that peers perceived their peer teachers to have improved their overall communication skills over the course. Every item but one on the CAT-SA demonstrated an increase from the beginning of the semester to

the end of the semester, indicating that students increased their overall communication skills over the course.

These results also converge with others' findings surrounding communication and peer teaching in gross anatomy lab contexts. Brueckner and MacPherson (2004) found that in addition to its intellectual benefits, peer teaching in the gross anatomy lab context also heightens students' sense of responsibility, increases self-confidence, and allows for growth in interpersonal communication and collaboration skills. Manyama et al. (2016) found that 95% of first-year medical students in their study either agreed or strongly agreed that their ability to interact and verbally communicate effectively with peers and faculty was improved after peer teaching sessions, and over 85% reported that peer teaching improved their confidence and ability to present information to peers and faculty.

Overall, our results indicate that using the CAT as a self- and peer-assessment for peer teaching in the dissection-based gross anatomy lab context can and should be used for students to begin to develop necessary communication skills required of physicians in their first year of medical school. The CAT as a self- and peer-assessment was found to have good to excellent reliability in the gross anatomy lab context, and CDPs were useful in determining what qualities students found most important regarding communication in the gross anatomy lab context, especially during peer teaching.

CHAPTER 5

A MIXED METHODS ANALYSIS OF FIRST-YEAR MEDICAL STUDENTS' TEAMWORK COMPETENCY DEVELOPMENT IN THE GROSS ANATOMY LABORATORY CONTEXT

5.1. Introduction

Systems-based practice is one of the six general competencies endorsed by the ACGME and ABMS that is used to evaluate medical residents and reflects a skill necessary of a practicing physician (Kavic, 2002). In resident education, systems-based practice involves the ability to effectively call on system resources to provide care that is of optimal value (Kavic, 2002). These system resources can include things like fellow physicians and members of medical teams—indicating the importance of teamwork interpersonally and interprofessionally. The AAMC has suggested expanding upon the six core competencies to include interprofessional collaboration, reflecting the broad acknowledgment of the importance of teamwork across the medical education continuum (Havyer et al., 2016). The AAMC, AACOM, and ACGME are currently sponsoring an initiative to develop a common set of foundational competencies for use in UME programs within the United States as a comprehensive effort to improve medical students' transition to residency (*Foundational,* 2024). Systems-based practice and interprofessional collaboration will be reflected within these foundational competencies, which will intend to represent minimum competencies for all medical students, regardless of degree type or eventual specialty of practice (*Foundational*, 2024). The ULSOM is

already including Systems-based practice and Interprofessional Collaboration as two of the core competencies within the school of medicine program objectives which all graduates should be able to demonstrate by graduation. Within these competencies, graduates should be able to provide care that is coordinated across teams, providers, and sites, work as a team member with other health professionals (*School of*, n.d.).

In 2011 and 2012, *Academic Medicine's* Question of the Year focused on promoting team behavior in medical school (UME) (Dougherty et al., 2018). As the importance of teamwork has garnered increasing attention with a drive to integrate this concept into the framework of curricular educational models (Dougherty et al., 2018), we suggest the gross anatomy laboratory with dissection-based learning as an opportune venue to implement teamwork competency assessment during the first year of UME.

Teamwork is a critical, core component within dissection-based gross anatomy lab courses. Teams who are not able to complete dissection goals/checklists during a lab session often have to dedicate more hours after the session, creating an imbalance in other academic responsibilities (Dougherty et al., 2018). Teams must work together to stay on task in this fast-paced educational lab environment. This resembles a surgical team in the medical setting and how each member must work together to ensure patient and colleague safety. This study intends to demonstrate how self- and peer-assessments of teamwork skills and reflection on teamwork skills are competency assessments that can and should occur in the gross anatomy lab context for first-year medical students.

This phase of the mixed-methods investigation of competency development is intended to 1) quantitatively determine whether first-year medical students' self-assessments of the teamwork competency in the gross anatomy lab context exhibit

change over time, 2) quantitatively determine whether first-year medical students' peer-assessments of the teamwork competency in the gross anatomy lab context exhibit change over time, 3) qualitatively analyze and contextualize student reflections on their baseline status, progress, and development of their teamwork competency throughout the gross anatomy course.

5.2. Materials and Methods

Overview of Methodology

This study was conducted under a convergent parallel mixed methods design (Figure 3.1.). The quantitative phase utilized a pretest/posttest design using the Teamwork Performance Scale (TPS) (Thompson et al., 2009). The intervention between the pretest and posttest was an Anatomy Team Charter (ATC) adapted from (Dougherty et al., 2018). The qualitative phase used student competency development portfolios (CDPs) developed for the competency-based curriculum in the CADE course at ULSOM as data materials. These portfolio entries were thematically analyzed using coding and grounded theory to describe how students perceive the development of their teamwork competency over the CADE course. The results from each phase of the study were then triangulated to give a holistic description of first-year medical student teamwork competency development over time in the gross anatomy lab context.

Quantitative Materials and Methodology

First-year medical students at ULSOM in the fall of 2022 completed quantitative self- and peer-assessments of teamwork skills using the previously validated 1-item Teamwork Performance Scale (TPS) adapted from Thompson et al. at the beginning and at the end of the gross anatomy course (n = 83). The TPS was developed as an instrument

to measure the quality of learning-team interactions in medical education settings (Thompson et al., 2009). The TPS was found to have evidence of convergent validity and high internal consistency (Cronbach's $\alpha = .97$) when used in team-based learning settings in medical schools and gives educators a tool to evaluate educational innovations/interventions that utilize teams or small-group interactions (Thompson et al., 2009). The researchers concluded that due to the high Cronbach's α result, it would be feasible to use a subsample of items on the TPS to further reduce the already low respondent burden of the instrument (Thompson et al., 2009). We adapted the 18-item TPS into a 17-item TPS to assess first-year medical students' teamwork skills in the gross anatomy lab context. The TPS for the gross anatomy lab context consists of 17 items scored on a Likert scale anchored by 1 (Not yet) and 5 (All of the time). Self-assessment (TPS-SA-1 and TPS-SA-2) and peer-assessment (TPS-PA-1 and TPS-PA-2) versions were created and can be found in Appendix C.

The quantitative phase of this study included several statistical analyses including an internal reliability assessment of the TPS-self-assessments and TPS-peer-assessments for use in the gross anatomy lab context, dependent paired samples *t*-tests of the self- and peer-assessment data, and measures of effect size. Data were analyzed within SPSS version 29.0, with a Bonferroni adjusted significance level of $p \leq .0083$. Before conducting any statistical analyses, the data were examined to ensure that the assumptions of the statistical tests were met.

Gross anatomy lab setting – Anatomy Team Charters (ATCs)

At the start of the CADE course, first-year medical students were assigned to a cadaveric donor at a table within a zone in the gross anatomy lab. There were roughly 28

tables utilized for medical gross anatomy each fall. Six to seven students were assigned to each donor, and those six to seven students were further subdivided into teams of three to four students, represented by groups A and B. The students were in these A and B teams all semester long at the same table and with the same cadaveric donor, and they alternated dissection days throughout the semester (30 lab sessions total). At the beginning of the semester, after only dissecting together once or twice, these teams of three to four students were asked to self-assess themselves, and peer-assess their two to three dissection teammates using the TPS-SA-1 and TPS-PA-1. The dissection teams were also tasked with developing an Anatomy Team Charter (ATC) by which to abide by over the course of the semester. A "team charter" is a document developed by all team members to outline team-specific goals and norms on tangible manifestations of professionalism and teamwork (e.g., attendance, tardiness, participation) (Dougherty et al., 2018). Refer to Appendix F for the ATC assignment description. At mid-semester, the dissection teams were tasked with revising their ATC based on their experience of team interactions and utility of their charter thus far in the semester. At the end of the semester, the dissection teams were asked to self-assess themselves and peer-assess their 2-3 dissection teammates using the TPS-SA-2 and TPS-PA-2.

Qualitative Methodology

The students completed three competency development portfolio (CDP) assignment entries throughout the CADE course (n = 83). The first entry at the beginning of the semester asked students to reflect on their strengths and weaknesses within the teamwork competency and to develop SMART goals for the competency. The second entry at mid-semester asked students to reflect on and track their progress in the

teamwork competency thus far and to revise or set new goals in the competency for the remainder of the semester. The third entry at the end of the semester asked students to reflect on their progression in the teamwork competency throughout the semester and to make a plan for how they will continuously maintain and improve their skills in the competency as it relates to the medical field (Appendix E).

Thematic analysis and grounded theory principles were used to qualitatively analyze the students' responses in their CDPs in the qualitative data analysis software MaxQDA version 22.5.0. Students' CDP part one entries were initially read, then coded, and then axially coded to find the main themes, and categories within those themes, present in first-year medical students' strengths and weaknesses and goals set within the Teamwork competency at the beginning of the semester. Students' CDP part two entries were then read, coded, then axially coded to find the main categories and themes present in students' progress in and reflections on their Teamwork competency goals set at the beginning of the semester. Students' CDP part 3 entries were then read, coded, and axially coded to find the main categories and themes present in the students' summative reflection on their overall development within the Teamwork competency over the CADE course.

CDP entries were coded until it was determined that thematic saturation was reached for the main categories and themes that erupted from the data during constant comparison of the dataset. Once this coding process was complete, selective coding across all three CDP entries was used to determine the most common themes and categories students discussed within their Teamwork competency development over the CADE course. These themes and their categories were then used to generate theories and

propositions that describes the interrelationship of the themes and categories to describe student perceptions on teamwork skill development in the gross anatomy lab context over time.

5.3. Results

Reliability Analyses

A Cronbach's α reliability analysis with an Intraclass Correlation Coefficient (ICC) confidence interval estimate was conducted to measure the internal consistency of the scale items on each version of the TPS. Cronbach's α and ICC estimates and their 95% confidence intervals were calculated using SPSS version 29.0 based on a 2-way mixed-effects model (Bravo & Potvin, 1991; Koo & Li, 2016). For the TPS-SA-1, the obtained ICC/α value is .844 (indicating good reliability), its 95% confidence interval ranges between .790 and .889, meaning that there is a 95% change that the true α value lands on any point between .790 and .889. For the TPS-SA-2, the obtained ICC/α value is .876 (indicating good reliability), its 95% confidence interval ranges between .833 and .911. Based on statistical inference, it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li, 2016). For the TPS-PA-1, the obtained ICC/α value is .910 (indicating excellent reliability), its 95% confidence interval ranges between .889 to .929. Based on statistical inference it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li, 2016). For the TPS-PA-2, the obtained ICC/α value is .928 (indicating excellent reliability), its 95% confidence interval ranges between .911 and .943. Table 5.1 illustrates these results.

Table 5.1

Cronbach's Alpha and ICC results for the TPS

	Cronbach's Alpha	Intraclass Correlation	95% Confidence Interval		N of Items
			Lower Bound	Upper Bound	
TPS-SA-1	.844	.844	.790	.889	17
TPS-SA-2	.876	.876	.833	.911	17
TPS-PA-1	.910	.910	.889	.929	17
TPS-PA-2	.928	.928	.911	.943	17

Scale Item Statistics

Item statistics are reported for each TPS-SA and TPS-PA in tables 5.2 and 5.3.

Table 5.2

Item Statistics for TPS-SAs

	TPS-SA-1		TPS-SA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
I make an effort to participate in team discussions.	4.81	.397	4.87	.341	83
I encourage team members to express their opinions and thoughts.	4.78	.443	4.77	.451	83
I share and receive criticism without making it personal.	4.64	.774	4.66	.668	83
I respect different points of view of my team members.	4.84	.529	4.94	.239	83
I help fellow team members to be understood by paraphrasing what they say.	4.34	.785	4.49	.755	83

I use several techniques for problem solving (such as brainstorming) and present my best ideas to the team.	4.49	.755	4.63	.557	83
I work to come up with solutions that satisfy all team members.	4.78	.443	4.83	.437	83
I consistently pay attention during group discussions/dissections.	4.82	.497	4.82	.387	83
I actively elicit multiple points of view from my team members before deciding on a final answer.	4.64	.636	4.76	.597	83
I listen to my team members when someone expresses a concern about individual or team performance.	4.82	.665	4.90	.297	83
I willingly participate in all relevant aspects of the team.	4.89	.313	4.86	.354	83
I resolve differences of opinion by openly speaking my mind.	4.39	.922	4.58	.718	83
I use feedback about my individual or team performance to help the team be more effective.	4.71	.725	4.83	.559	83
I am attentive to what other team members are saying when they speak.	4.92	.280	4.90	.297	83
I assist in resolving conflicts by compromising with my team members.	4.59	.988	4.84	.366	83
If I have a different opinion than my team members, I explain my point of view to the team.	4.54	.754	4.76	.430	83

I recognize my team members when something they say helps the team reach a good decision.	4.89	.313	4.89	.313	83

Table 5.3

Item Statistics for TPS-PAs

	TPS-PA-1		TPS-PA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
Team member makes an effort to participate in discussions.	4.90	.372	4.89	.335	169
Team member encourages other team members to express their opinions and thoughts.	4.83	.450	4.82	.471	169
Team member shares and receives criticism without making it personal.	4.79	.689	4.77	.748	169
Different points of view are respected by this team member	4.91	.412	4.89	.363	169
Team member often helps fellow team members to be understood by paraphrasing what they say.	4.70	.678	4.71	.631	169
Team member uses several techniques for problem solving (such as brainstorming) by presenting their best ideas.	4.72	.717	4.82	.445	169
Team member works to come up with solutions that satisfy all team members.	4.79	.533	4.88	.396	169
Team member consistently pays attention during group discussions/dissections.	4.86	.427	4.85	.445	169

Team member actively elicits multiple points of view before deciding on a final answer.	4.74	.600	4.81	.607	169
Team member listens when someone on the team expresses a concern about individual or team performance.	4.77	.838	4.89	.442	169
Team member willingly participates in all relevant aspects of the team.	4.89	.414	4.92	.289	169
Team member resolves differences of opinion by openly speaking their mind.	4.72	.839	4.85	.484	169
Team member uses feedback about individual or team performance to help the team be more effective.	4.83	.553	4.85	.546	169
Team member seems attentive to what other team members say when they speak.	4.88	.375	4.89	.385	169
Team member is able to resolve conflicts by compromising with other team members.	4.70	.856	4.87	.457	169
Team member explains their point of view to the team when they have a different opinion than the rest of the team.	4.80	.593	4.89	.363	169
Team member is recognized when something they said helped the team reach a good decision.	4.89	.352	4.93	.270	169

Quantitative: TPS-self-assessments dependent t-tests

The TPS-self-assessment was utilized at pretest (TPS-SA-1) and sought to measure self-assessed levels of teamwork skills at the beginning of the semester. The TPS-self-assessment was utilized again at posttest (TPS-SA-2) and sought then to

measure self-assessed levels of teamwork skills at the end of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the TPS-self-assessment was utilized to determine whether change is self-perceived by first-year medical students. A paired samples t-test is most appropriate because the data were collected from the same group of students at two different time points (n = 83).

There was no statistical difference in TPS-self-assessment scores from Time 1 (*M* = 4.70, *SD* = .341) to Time 2 (*M* = 4.78, *SD* = .279), *t* (82) = -2.656, *p* = .009 (two-tailed). The mean difference in TPS-self-assessment scores was .085 with a 95% confidence interval ranging from -.149 to -.021. Cohen's D, a measure of effect size, showed a small effect (.2917). Tables 5.4-5.6 and Figure 5.1 illustrate these results.

Table 5.4

Paired Samples Statistics for TPS-SAs

	Mean	N	Std. Deviation	Std. Error Mean
TPS-SA-1	4.70	83	.341	.037
TPS-SA-2	4.78	83	.279	.030

Table 5.5

Paired Samples Test for TPS-SAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
TPS-SA-1 to TPS-SA-2	-.085	.292	.032	-.1487	-.0213	-2.656	82	.009

Table 5.6

Paired Samples Effect Sizes for TPS-SAs

			Point	95% Confidence Interval	
		Standardizer[a]	Estimate	Lower	Upper
TPS-SA-1 - TPS-SA-2	Cohen's d	.2917	-.292	-.510	-.071

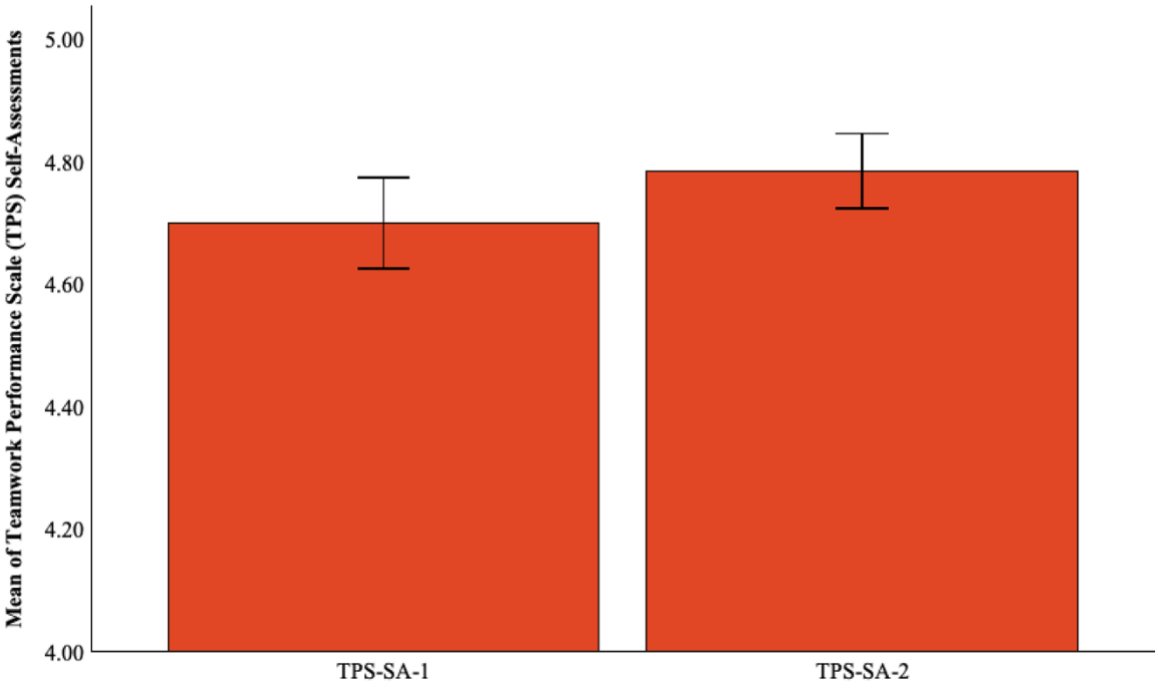

Figure 5.1. Teamwork Performance Scale Self-Assessments

Quantitative: TPS-peer-assessments

The TPS-peer-assessment was utilized at pretest (TPS-PA-1) and sought to measure levels of communication skills of peers at the beginning of the semester. The TPS-peer-assessment was utilized again at posttest (TPS-PA-2) and sought then to measure levels of communication skills of peers at the end of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the TPS-peer-assessment was utilized to determine whether change is peer-perceived by first-year medical students. A paired

samples *t*-test is most appropriate because the data were collected from the same group of students' peer-assessing the same group of students at two different time points (n = 83).

There was no statistical difference in TPS-peer-assessment scores from Time 1 (*M* = 4.81, *SD* = .300) to Time 2 (*M* = 4.85, *SD* = .234), *t* (82) = -1.948, *p* = .055 (two-tailed). The mean difference in TPS-peer-assessment scores was .048 with a 95% confidence interval ranging from .025 to .001. Cohen's D, a measure of effect size, showed a small effect (.224). Tables 5.5-5.7 and Figure 5.2 illustrate these results.

Table 5.7

Paired Samples Statistics for TPS-PAs

	Mean	N	Std. Deviation	Std. Error Mean
TPS-PA-1	4.81	83	.300	.033
TPS-PA-2	4.85	83	.234	.026

Table 5.8

Paired Samples Test for TPS-PAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
TPS-PA-1 to TPS-PA-2	-.048	.224	.026	.025	.001	-1.948	82	.055

Table 5.9

Paired Samples Effect Sizes for TPS-PAs

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
TPS-PA-1 - TPS-PA-2	Cohen's d	.224	-.214	-.431	.004

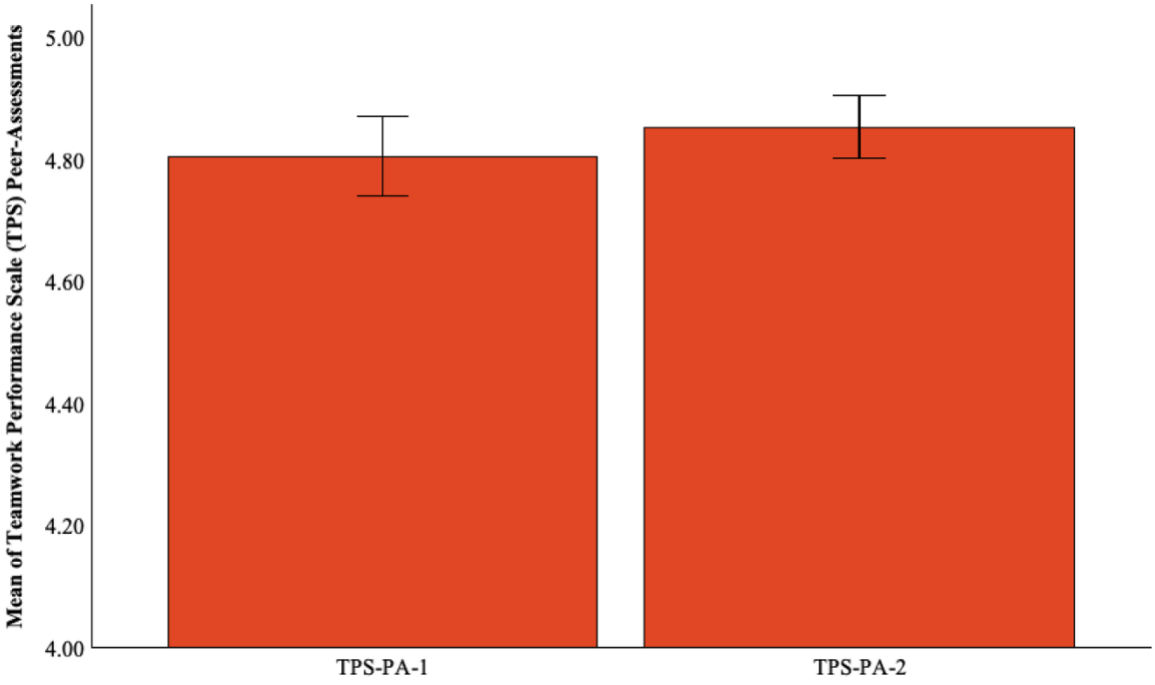

Figure 5.2. Teamwork Performance Scale Peer-Assessments

Qualitative Results

Qualitative methodologies of thematic analysis with grounded theory principles were utilized to examine student reflections on their baseline status, progress, and development within the Teamwork competency during the CADE course. The goal of this analysis was to explore and contextualize the personal strengths and weaknesses and experiences students had whilst developing their communication competency during the CADE course.

Baseline Status and Goal Setting

In CDP part one, students were asked to reflect on their self-perceived strengths and weaknesses in the teamwork competency as well as to set SMART goals for improving their skills in their teamwork competency over the CADE course. The major theme of CDP part one involved strengths, weaknesses, and goals surrounding

Collaboration Skills. Ensuring team equity and delegation and distribution of dissection tasks during lab, supporting and encouraging teammates, and asking for feedback from teammates were the most common categories mentioned within this theme. Many students also discussed their general belief of working well in team settings and using teammate reassurance as a success measure for improving skills in the teamwork competency. Table 5.10 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.10

Theme: Collaboration Skills		
Category:		
	Strength or Weakness	Related Goals
Ensuring Equity amongst team	Areas of Strength: Ensuring that each of my peers has equal dissection time throughout challenging and less challenging duties ID55 Strengths: I always have the equity of sharing roles in the forefront of my mind ID14 My strengths are that I do ensure equitable distribution and help/support my teammates. ID20 Weaknesses: equitable distribution of dissection duties ID10 I think the one thing that is a weakness is the delegation of tasks and holding my teammates accountable in sharing the responsibility. ID66 Weakness: sharing of roles -- It doesn't feel like we all contribute the same amount in all ways ID60	With the use of my team's charter, we have agreed to switch off roles every 45 minutes up to 1 hour to ensure that everyone has equal dissection time. ID55 I want to make sure that my team is equally splitting up duties and no one is doing more than they feel like they should. By doing this I am hoping to improve the equitable distribution of dissection duties. ID53 I want to not take on too much work in the project. To do this, I will set concrete goals with others and not take on more work. If those goals change overtime and the workload shifts, I will tell the others and encourage them to tell me so we can reevaluate the work balance. ID33 Make splitting of dissection duties more equal. I want to make sure [teammate1] gets more time cutting if she desires and that [teammate 2] doesn't do all the hard work. ID60

Support and Encourage the Team	I also believe I am strong in providing encouragement and feedback related to the dissection as my peers are doing their portion of it. ID61 Strength: support -- I let my team members know when they've done a great job on a particular part of the dissection ID60 I also support my team members in teaming up to study together, reexplain material to them, and also encourage collaboration. ID66 strength- support my team's progress. ID46 A strength I have in this competency is supporting each other's progress. ID53 Weakness: Going out of my way to praise my peers for their successes ID13 I also think one of my strengths is that I enjoy complimenting team members on a job well done. ID27 Strength: I celebrate my peers and their successes through affirmations and encourage them when they are struggling to understand a concept. ID31	My goal is to be an equal and caring teammate that is considerate about my peers situations inside and outside of the medical school environment. ID38 A goal of mine is to celebrate the wins of each individual in the team ID69 I will be a good teammate by praising my teammates when they do something well such as properly dissecting a structure ID20 Make a conscious effort to praise my peers for their achievements. I will do this by verbally recognizing their successes when we are working together during dissections and when meeting outside of classes to study. ID13 One goal is to celebrate my teammates when I notice them excelling at a certain role in the lab (identifying structures, guiding the team with the lab guide etc.) ID64 I will try to instill confidence in my teammates that they are making the right decision as we discuss it together. ID44 I will attempt to achieve this goal by making my peers feel validated and confident in their work via verbal affirmations. ID64
Belief of working well in teams	I think I always strive to be a great team player. ID66 I believe that I am a strong teammate. I always try very hard to ensure that every member of the team feels valued and respected. ID47 I believe I am always willing to participate and do my part as a member of the team when dissecting in lab. ID76 I am overall a team player ID27 Coming from an engineering background that highly emphasized teamwork skills I feel very competent with my teamwork skills. ID81	

	Areas of strength: I have been on a team my entire life, so I know pretty well how to work with others--especially with a diverse set of people who bring different things to the table. ID44 I think i am good at teamwork ID38
Using teammate feedback to improve skills	To measure this, I could check with my teammates and make sure they feel I'm contributing my fair share. ID27 Speaking with classmates about how they feel about their involvement in the session and how they feel about my involvement, trying to create the most open and safe environment for discussion possible, I believe this could help articulate feedback on my progress as well. ID54 Our success can be assessed towards the end of each lab by reassuring that everyone has learned that days objectives and also by covering the whole manual. ID46 I will identify that this goal has been successful by conversing with my peers and asking them for feedback. ID47 I will ask for feedback from my lab group peers on my contributions and whether they consider them meaningful after each lab. ID77

The second theme of CDP part one involved conflict and problem-solving skills. Several students discussed their difficulty with navigating and addressing conflicts when they arise, while only a few mentioned this as a strength and skill. Many students also recognized the importance of the ability to give and take constructive feedback within a team setting. Table 5.11 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.11

Theme: Conflict/Problem-Solving Skills		
Category:		
	Strength or Weakness	Related Goals
Navigating conflict	Weaknesses: Addressing conflict ID70 Weakness – Flexibility is often times a weakness of mine in addition to	I would like to improve my confrontation skills because at times it is necessary to speak up if a conflict arises. Confronting conflict is a challenge for me but I think working with a team is a great way to exercise

	creative problem solving and/or conflict resolution. ID21 My weaknesses are that I do not confront conflict when necessary ID20 Sometimes I try to avoid conflict in order to keep the peace, but that just leads to further tension which may hinder the group from executing as effectively as possible. ID85 I feel that my strengths are that I am overall a team player and make it a priority to avoid conflict. I typically try to ease any tension within a team atmosphere ID27	that muscle. I will remember that it is for the betterment of the group and that everyone is able to feel seen and heard. ID85 When/if conflict arises, kindly tell that person directly what and why their behavior is bothersome ID70 Navigating Conflict Between peers While I am good at de-escalating conflict when I am directly involved, I am poor at inserting myself into conflict to de-escalate conflicts between lab peers when I am not involved. b. Achieving the Goal i. Giving my team members 4-5 minutes to work through their conflict before inserting myself and helping them reach an amicable resolution. ID55
Constructive feedback and mediation skills	An area of strength I believe I have in teamwork is conflict management; I am usually a good mediator between teammates in conflict and help the team as a whole achieve resolutions/compromises. ID77 I believe that my mediation skills work well on a team. ID64 I am able to give and take constructive criticism. ID50 Strengths: Conscientious of others when providing constructive feedback, explanations, or asking them to do something. ID70	My SMART goal related to this competency is to work on my ability to give constructive and effective feedback with group members. ID34 Goal: Step out of my comfort zone and give better feedback/instructions to team members when we are dissecting or they are peer teaching. a. This would entail asking more questions or providing feedback for the peer teacher so that they can improve their skills ID10 I will also give constructive feedback to my classmates; I will say one positive and one improvement that they might need. ID18 My goal is to develop my ability to give constructive feedback. This is difficult to do among peers as we are all on the same level, and I wouldn't want anyone to feel as if I am being condescending or nitpicking. I think being able to provide constructive feedback to peers can be very beneficial. Likewise, I think it is very valuable to have the ability to receive constructive feedback from peers in a healthy way. ID47

The third theme that arose in CDP part one was team engagement. Here, students discussed leadership preferences and recognized the importance of relinquishing control for the betterment of the team. Many students mentioned the difficulties they have with relinquishing control and trusting teammates to do their duties. They also mentioned how preparation for lab, or lack thereof, can affect team dynamics and confidence levels. Wanting to improve contributions to the team and checking in with teammates frequently were some of the goals set within this theme. Table 5.12 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.12

Theme: Team Engagement		
Category:		
	Strength or Weakness	Related Goals
Leadership	A weakness I have in teamwork is taking the lead role sometimes; I am usually a work-in-the-background kind of person and am less likely to take the mic to give an answer for our group or be the lead dissector. ID77 My biggest strength would be taking leadership of most of the teams I've been a part of to ensure success of whatever task we are assigned. ID81 I've also tend to taken on the leadership role even if I didn't want it just so things get done. ID50 Although I would enjoy more time with the scalpel, I understand that this is a group learning experience. I have made an effort to make sure all members of the group get an equitable amount of time being team lead. ID22	Through the rest of the semester in CADE, I will strive not to take over tasks that aren't getting completed to my standard. I will instead encourage other members to jump into that task instead or be a helping hand in getting it completed ID66 I just need to encourage everyone to do their best but not apply my standards to others. ID81 One goal to work on is giving others the opportunity to engage in certain activities that I usually do. An example of this would be asking if my team members want to dissect in lab instead of me. ID4

Subcategory: Difficulty Relinquishing control	One of my weaknesses in this area is that I become attached to one role and have a reluctance to switch, even though I know that rotating positions helps everyone on the team become a more developed student. ID64 I think my biggest weakness is sometimes I tend to have a more dominant personality. I prefer to be in a position of leadership, and this can sometimes upset others that are maybe not as outspoken in a team atmosphere. ID16 Weakness: I need to work on letting others take the initiative rather than try to do all of the tasks (i.e. doing all of the dissections, listen to my teammates suggestions, etc.) ID4 Weakness: I have a hard time relying on others because I am worried that they will mess the task up. ID28 Areas of weakness: making sure I don't feel overwhelmed by other's actions or needing to make sure that everything is done perfectly. ID44	My goal for improving my teamwork competency is to make more of an effort to resist placing myself in a self appointed position of leadership. I want everyone to feel as though they are an equal contributer to our team, and to never feel as though i am bossing them around or placing a higher value on my own ideas compared to theirs. I will do so by not always being the first person to speak nor the loudest person at the table. ID16
Participation and Preparation	I believe I am always willing to participate and do my part as a member of the team when dissecting in lab. I do not think that I am always prepared for lab in my knowledge of the material from lecture prior to lab day. ID76 I have come to lab without fully understanding the anatomy and feel that I am bringing the group down. ID22 I think I may be weakened in confidence sometimes regarding initiating the dissection. ID61 Strengths – An aspect of teamwork which I consider to be a great	I will work to come to each lab more prepared to handle the day's assignment by reviewing the lab manual and watching the Aceland videos by the night before our lab meeting. ID22 I will spend more time with the lecture material that correlates to the day's dissection prior to arriving in lab. This will help me be more knowledgeable and increase my ability to contribute when a teammate has a question or when we are discussing the dissection. I can do this by being more on top of my studying and making sure I find time to review the lecture material before arriving to lab. ID76

	strength of mine is responsibility, commitment, and willingness to lend a helping hand. As students, we are not traversing the challenges of medical school alone. To make this educational experience tolerable and positive, we must be able to rely on each other. ID21	I want to be better about stepping in and making sure I am contributing as much as I can and not holding back because I'm worried about stepping on someone's toes. ID27 When I am in charge of overseeing dissection steps, I will utilize that time productively to be the point-person to seek help if my teammates run into a question while dissecting. While I am not actively assisting with dissection, I can be a great resource for my teammates to find answers efficiently while they are working directly with the body. ID58

Progress

In CDP part two, students were asked to reflect on their initial progress in their teamwork competency goals set earlier in the semester in CDP part one and to revise those goals or set new goals for the remainder of the CADE course. Here, students mainly reflected upon their progression toward their goals—whether they had improved upon or met their initial goal, were still working toward it, and the general recognition of needing to work on teamwork skills. Students mentioned their feelings toward the formative feedback they received at mid-term within this CDP as well. They also reflected upon their collaboration skills development, team engagement/participation, and conflict/problem solving skills, and many discussed how well their teams had been working together since the start of the semester.

The main theme of CDP part two was students' progression toward their set goal(s). Here students discussed that they had intentionally worked toward the goal(s) they set at the beginning of the semester and if they still had work to do on their goals.

Table 5.13 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.13

Theme: Progression toward Goals	
Categories:	
Have Intentionally worked on Teamwork Competency	I have been working on improving as a team member. ID64 I have been working on improving this competency and feel that I've gotten better at delegating work out to others.ID33 I have actively working on being a better team member by not working ahead of my group ID18 I have worked on my teamwork competency by ensuring all my teammates were treated equal, and we have created an atmosphere of collaboration and trust which better fosters learning. ID20 I have intentionally worked on my teamwork competency by making sure everyone has a role at all times ID3 My goals for teamwork have been progressing smoothly. ID54 I have worked on improving this competency based on my initial goals. ID35
Subcategory: Still working toward goals	My initial goal in this competency was to speak up with my peers if an issue arises. I would say that I am still working on achieving this goal this semester. ID85 I would say I am still working on completely "mastering" my goals of teamwork for this semester. While I acknowledge my significant improvement thus far, I still have some days where I get behind on being ahead, and I am not as knowledgeable as I would be comfortable with when it comes to the relevant, corresponding lecture materials. ID61
Subcategory: Improved upon goals	As I have gotten into more of a "groove" when it comes to studying and staying on top of lecture material, I would say that I have significantly improved upon my goals of being confident in my abilities. ID61 I am confident I have improved my teamwork skills since setting this goal. ID58 My original goal regarding teamwork was to ensure I wasn't allowing my dominant, outspoken, and sometimes potentially overbearing personality prevent me from allowing my teammates to be as active or involved in our dissections as they wish. I believe I

	have improved immensely regarding this goal by taking turns with my teammates when it comes to being a lead dissector, and by consistently asking them if they want to take charge or be more involved during our labs. ID16

Feelings toward feedback was a second common theme present in CDP part two. Students were largely unsurprised by the feedback they received and claimed that the feedback they received was mainly positive and they were happy to receive such feedback. Very few students mentioned if they were disappointed or surprised with the feedback received. Table 5.14 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.14

Theme: Feelings toward Feedback	
Categories:	
Unsurprised	I was not surprised by the feedback I received on my teamwork. It was my lowest score and I believe it's because I can often steamroll other members of a group that are quieter ID64 I was not surprised by my feedback because I knew this was something I needed to work on ID19 I was not surprised by the feedback I received on this competency ID21 I'm unsurprised by my high teamwork score. ID60 I was not surprised by the formative feedback because I think our lab group works very well together overall and knew that work would reflect that. ID35 I have been working on improving this competency and feel that I've gotten better at delegating work out to others. I was not surprised by the feedback I received. ID33
Positive	I have received kind verbal feedback from my peers that my leadership has been appreciated. ID58 I was also pleased to receive full marks in the teamwork category from my formative feedback. ID66

	I was happy to see that I also received a pretty high score for teamwork as well as this is something I have been working to get better at. ID85 I was happy with my formative feedback as I feel that teamwork is one of my strengths. ID27 My formative feedback was very favorable in my ability to keep our team working together effortlessly. I was pleased to see this ID55 I was glad to see a good teamwork score. ID20 I felt that the formative feedback on my teamwork skills properly reflected my work on this competency. ID77

A few themes recurred from CDP part one in CDP part two as students revised/set new goals for the remainder of the semester. The Collaboration Skills theme appeared again as students discussed how ensuring equitable dissection duties was progressing and recognizing increased skills like providing more team encouragement and praising peers and becoming stronger at asking for help when needed. The main aspect of this theme was students discussing how well they perceived that their team worked together, resulting in a shifted focus from individual teamwork skills in CDP part one, to how their team was performing as a whole as the semester progressed in CDP part two. Table 5.15 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.15

Theme: Collaboration Skills	
Category	Excerpts
Team works well together	My group works together very well so it is difficult to pinpoint any specific actions I could take to improve our effectiveness. ID78 we have agreed that we are extremely satisfied with the level of harmony our group has been able to achieve. ID77

	We have worked so well together this semester, and all bring very valuable skills to the group. ID58 our lab group works very well together overall ID35 Instead of only checking periodically like I planned to, I feel like my team has done a good job of talking and keeping communication open the whole time we are dissecting so that we always know how we are feeling about the dissection and our roles. ID53 we have had a good team and team dynamics. ID46
Team Equity	I still feel that I should spend more time ensuring equal dissection times between the three of us. One person tends to fall toward the book/iPad to develop a better understanding of the dissection for all of us. My revised goal is, instead of going based off tiredness, I will work on ensuring that each member receives adequate dissection time by using the clock as an indicator. ID55 My goals for the rest of the semester are to be conscious of asking for input from the rest of my team members about the plan for the day (who will be dissecting what and checking in frequently to see if people want to change roles) ID71 I can still work on this skill. I think a revision would be to make more of an effort to vocalize our responsibilities and roles before we dissect so we are on the same page and can take appropriate turns. ID19 I have made an effort to share more responsibilities in the lab ID22 I think our entire lab group has done a much better job at allocating tasks over the last few months. We have developed more trust amongst each other and now delegate different tasks very easily. ID28 we have created an atmosphere of collaboration and trust which better fosters learning. ID20
Praising peers	I can improve my skills by praising my peers before they get to the point where they feel negatively and unsure about themselves. ID13 I want to work on creating alternate goals in doing teamwork by being more vocal and encouraging in my vocal interactions. Simply by showing affirmations and being encouraging, overall attitudes will be far more positive, and I value this sort of environment in performing as a group. ID54 I will also give words of affirmation to my group members when they do really well with their dissection parts. For instance, [teammate1] is talented at clearing away fascia quickly while [teammate2] is good at quizzing us as we go to make connections between lab and lecture. ID31

	One goal that I have for the remainder of this semester is making sure I verbally congratulate my team whenever they are doing well. For example, whenever they have done a really great dissection or found a difficult structure, making it a point to tell them "good job." ID27 To further improve this competency, I will start by giving a compliment or statement on what my peers are doing really well. Then I will follow that comment by stating that from my previous gross anatomy experience, I may have an easier way of doing something and explain that method. ID47

The team engagement theme recurred in CDP part two, with students discussing the progression of their leadership abilities, preparation for lab as a factor influencing teamwork abilities, and the desire to bond with teammates outside of the lab setting to further increase team effectiveness. Using teammates as a learning tool was a new category mentioned by students within this theme, where students recognized that it is important for everyone on the team to be successful in gross anatomy lab and using each other is one way to help find that success. Bonding with teammates outside of lab was also another frequently mentioned category. Table 5.16 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.16

Theme: Team Engagement	
Category	Excerpts
Leadership	I feel like I've improved as a leader ID33 I still believe that I could be a bigger presence within my lab group for balancing teamwork. There are times where one or two people are doing most of the heavy lifting. I believe my personal development could be furthered if I stepped up more as a leader. ID23 I believe I did a better job not dictating every move of my lab group. In times where we didn't know whether we could cut a structure in the body or other labeling issues, I listened to everybody's perspective and we would make a decision by voting. ID9

	One goal regarding the teamwork competency I have been working on is to take initiative on behalf of my team more often and be intentional about no one person doing an unequal share of the work. ID77
Participation/Preparation	I can continue to improve my teamwork competency with this goal by making sure I am adequately prepared for lab all of the time instead of most of the time. I can also make sure I am completing the same task of reviewing lecture material prior to lab for both topics that are being peer taught to me as well as for topics in which I am completing the dissection. ID76 making sure that I contribute by making notes on the lab sheets before each dissection to help guide us as we work. I made lab sheet notes with pictures from the lecture that we had received before one of the harder dissections we completed and everyone seemed to think it was beneficial. I will track my progress by making sure that the lab sheets are done before arriving ID71 If I need help in the area I am working on, I will verbalize that with my team. ID28 Although I do contribute, I am often afraid to say things sometimes out of the fear of being wrong. I am now understanding that it is a time to learn and correct our mistakes, so being a team player in these settings is beneficial for all of us, so that we can think through problems collectively and learn from errors. ID33 I have worked on initiating more conversation, discussion topics, and talking through difficult lab/lecture concepts with my team. This has worked to continue the learning and understanding of my teammates and myself and keep our team working as a team. ID55 I have worked on speaking up and asking if I can do something ID27
Team bonding	A new goal I'd like to work on for this competency would be to encourage teamwork in my lab group not just during required events like labs and quizzes but outside of class as well. ID77 another goal I would like to create is building a stronger lab team by spending time outside of lab with my members and doing social activities outside of school. This will create a stronger team which will also help us when working together in lab. ID20 I feel like I can improve my teamwork skills by asking them if they ever want to study or review our body together outside of lab! I believe great teamwork skills should go beyond designated lab times and include ensuring your teammates are excelling in all parts of lab, such as the practical! ID16 I would like to create a new goal of working with my teammates beyond our assigned group work and provide an outside resource/support to them ID38

	I would also like to connect more with my lab mates in order to make lab a little more enjoyable. ID50
Use team as a learning tool	I think that I need improve on gathering my teammates points of view and learning from them rather than solely relying on myself. ID4 I think a great goal for us as a team would be to increase our learning output in the lab. Similar to my personal goals, we could ask each other questions and quiz each other on the content we are studying that relates to the structures we are dissecting ID60 I will ensure that we quiz each other over structures as we go along, and use the time left in lab after finishing to continue running through the structure list until we have all mastered them equally. ID78

The conflict/problem solving theme arose again in CDP part two, but it was not as prevalent as it was in CDP part one. Students who did discuss conflict/problem solving mentioned how they had not had any major conflicts or disagreements within their teams yet. Table 5.17 illustrates the created category along with excerpts from the dataset to illustrate why this category was created.

Table 5.17

Theme: Conflict/Problem solving Skills	
Category	Excerpts
Lack of conflict	Although in general I do feel a lot more comfortable with my labmates, fortunately a situation has not arisen yet where I've had to speak up on conflict, so I haven't really been able to gauge whether this us something I've achieved or not yet. ID85 My original goal was to get better at reducing conflict. However, I've been fortunate to have a really great group and we haven't had any conflicts yet. ID70 One of my goals was to be more vocal if there is disagreement which I would say outside of the lab i'm doing well but we rarely have any major disagreements in lab. ID75 there is limited disagreement and if there is we talk and discuss it in a respectful way. ID44

Development

In CDP part three, students were asked to give a summative reflection on their overall development within the Teamwork competency throughout the CADE course (from August-December) as well as to discuss how they will continuously maintain/improve skills in this competency as it relates to the medical field moving forward. Here, students mainly discussed their intentionality toward improving their teamwork skills over the semester, with an overall belief of self-improved skills and team-improved skills and positive feelings toward the summative feedback they received at the end of the semester. They also discussed realizations of the many benefits of teamwork and how teamwork will be crucial in the medical field as they move forward.

The first theme of CDP part three was the belief of improved teamwork skills over the CADE course. Most students mentioned a general belief of improved teamwork skills from the beginning of the semester. Many students, however, gave specific information as to what skills they believed they improved within their teamwork competency over the semester, specifically relating to improved collaboration skills and team engagement skills. Table 5.18 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.18

Theme: Belief of Self-Improved Teamwork Skills	
Category:	
Collaboration Skills	I believe I have improved as a member of a team by learning to give other team members space to learn in the lab setting as well. ID64 I know I have improved my skills based on how my team works together to complete tasks in a timely manner. ID69 I also learned how to become a better team player and how to make decisions that not only benefit me, but the entirety of the group. ID85 what i noticed the most improvement was delegating tasks for teammates in lab or switching off roles. Given my lab group had 4 people we always had more people than tasks. So i found myself always making sure teammates had something to keep them busy and at the same time i made sure everyone got their chance to dissect each lab if they desired. ID81 I have been able to rely on my team and in turn have been a person they can rely on, from meeting up outside lab time to work through checklists together to answering quick questions about lecture content in the group chat. ID77 I was more encouraging of my teammates and acknowledged when they did something well. ID20 Since August I have learned how to adequately share responsibility with my team. ID69 I think my teamwork skills have improved since august by working with different groups compiled of diverse individuals. ID19 I feel like I have improved my teamwork skills by becoming much more comfortable working so closely with a group to accomplish a task. ID53 I believe my teamwork skills improved quite a bit. I know they improved because our lab skills became more efficient and cooperative. ID38 working with such an amazing class gave me more opportunities to expand my trust in teammates rather than just relying on my one work. ID54
Team Engagement Skills	My teamwork improved as I got to know my table mates and how they prefer to work. ID4 Since August, I have grown really close to my team and have been able to work in harmony with them. ID77

Subcategory: Team Bonding	I have tried to improve my teamwork skills by learning more about each of my team members and how they work and learn most effectively. ID28 As I got to know my peers' personalities better, it became much easier to predict their feelings and behaviors and know when to step in and give them reassurance before it got to a point where they were feeling negatively about their performance. ID13
Subcategory: Leadership Abilities	I feel the way I have improved in this competency is my leadership skills. I think one thing that is important when being a leader is promoting a positive environment where people enjoy being there and feel that they can come to you with any issues. ID27 I think I stepped up more as a leader among my peers and learned how to encourage others to step up ID23 I feel I best contributed with decision making and acting in times when we were nervous to make a step forward. ID14 I believe I have improved my teamwork skills since August. As the course progressed, I became much more confident in the role of lead dissector ID52 I think I have improved my skills throughout the semester by becoming comfortable with others taking the lead when it came to dissection. I have been known in past to be a control freak, and assert myself as a leader amongst peers that are meant to be equals. I think I have done a much better job in allowing others to take charge ID16

The second theme of CDP part three was the belief of team-improved teamwork skills. Here, students discussed how they perceived their team dynamics progressed throughout the semester and a general overall belief that their teams got better at teamwork as the semester progressed. Collaboration skills with a focus on how teams built trust and established team equity, and team engagement skills like team bonding were most focused on within this theme. Table 5.19 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.19

Theme: Belief of Team-Improved Teamwork Skills	
Subtheme:	
Collaboration Skills	
Category: Trust	I have been able to rely on my team and in turn have been a person they can rely on, from meeting up outside lab time to work through checklists together to answering quick questions about lecture content in the group chat. ID77 I believe I have improved in this skill by building trust with my team through celebrating our successes and building each other up when we feel discouraged. ID31 I am usually really hesitant to work in a team because we have to accommodate different work styles. I have become more comfortable working in a team and open to changes that come about in a team. ID50
Category: Team equity in lab	I think that my peers and I have seen great improvements in allotting equal time in lab and with instructors... We got much better as Block 5 rolled around on divvying up tasks and deferring to the judgment of our peers. ID55 I have watched my team members all become more competent and confident in the lab setting. I have also seen gains in our dissection sessions at a team, and we had fewer roadblocks as the year went on. ID64 our lab skills became more efficient and cooperative. ID38 I feel as if each of my team members and I became more comfortable assuming and changing roles with each lab. ID76
Team Engagement	I know our team chemistry grew throughout the semester ID3 Throughout the semester, I feel our team was made stronger because we started understanding the nuances of who we are as people and how that contributes to our team ID14 When there was any downtime in lab such as when we were working on a non-meticulous task or waiting for a professor, my teammates and I tried to get to know each other better by asking questions about what we did before med school, what specialties we are interested in, etc. This not only build a stronger bond within our team, but it was also helpful in understanding how each member learned effectively. ID28 Typically, we were not afraid of asking for help from each other and in most cases, we didn't feel the need to have faculty involved. ID4

Category: Team bonding	We have also taken a break from studying and gone out to eat together just to check in with one another as people and make time for one another. ID77 Everyone in our group has their different strengths and as we learned them throughout the semester we were able to work better as a team. ID19

The conflict/problem solving skills theme recurred in that students noted not having much conflict within their teams over the course of the semester, but recognizing needing to improve being able to give constructive feedback to others and confronting conflict in the future if it arises. Table 5.20 illustrates the created category along with excerpts from the dataset to illustrate why this category was created.

Table 5.20

Theme: Conflict/Problem solving Skills	
Category	Excerpts
An area to still improve upon	I can still work on providing constructive feedback to our team members. ID46 I have been working on my ability to provide constructive feedback. I do still think I can improve on this ability as I will often "hold my tongue" and stay silent rather than saying anything. It is difficult to do as we are all on the same level, and I don't feel comfortable critiquing my peers as I feel that I have no authority to do so. ID47 One aspect that I would still like to improve on is giving feedback to team members if I disagree with something ID53 I could still work on encouraging the engagement of my peers in a constructive and meaningful way. ID61 I think i can still improve in my ability to say what I want and not be afraid of asking too much of others. ID38 An aspect of the teamwork competency I could still improve in would be confronting conflict, because this wasn't really an issue that arose with my team and thus this is one aspect of teamwork I didn't really practice, although it will be an important skill to have in future teams I will be a part of. ID77

Another theme present in CDP part three was students' feelings toward the summative feedback they received at the end of the semester. Students were mostly unsurprised by their feedback, and feedback was positive more often than not. Some students claimed that the feedback they received reflected their growth within the teamwork competency, while others discussed how they were happy with their feedback and also expected the positive feedback they received. Table 5.21 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.21

Theme: Feelings toward Feedback	
Category:	
Positive Subcategory: Not surprised	I believe I have improved my skills in teamwork based on feedback from my team members, and thus was not surprised by the formative feedback I received. ID77 I believe I have improved my teamwork skills but which is why I am not surprised by my formative feedback the second time around. ID37 I was happy with the comments I received on my formative feedback this time around. ID27 I was grateful for the formative feedback because I worked hard to expand on this goal during part 2 of the CDP. ID31 I learned how far a little positivity went when working a team. I was really glad to receive that positive feedback and this pushed me to continue to lead our group through the dissection steps more confidently. ID58 I think my feedback adequately reflected my expertise in this area. ID44 I was not surprised by the formative feedback. I felt that I was a good teammate, and the formative feedback reflected this. ID47
Feedback reflects improvements	I think my formative feedback reflects these improvements. ID76 I was happy to see my growth acknowledged in my feedback progress. ID61

	I feel, and my feedback reflects my growth/progression in my teamwork in the lab. ID19 I was shocked by the feedback I received the first time around. I did not know I was not being present for my teammates. I made it a priority to make sure I was mentally and physically present during group interactions. I went with my professors one-on-one to assist me on how I can further improve. I was proud that the second time around when it was noted that I was heading in the right direction. ID18

The final theme of CDP part three involved the maintenance of and importance of teamwork in the medical field. Here, students discussed how reflection and asking for feedback from others will be mechanisms for maintaining and improving this competency as they move forward in their medical education and career. They also discussed plans for how to take what they had learned from teamwork in the gross anatomy lab context forward in their future team interactions and recognized that teamwork is an inherent aspect of the medical field. Table 5.22 illustrates the created categories along with excerpts from the dataset to illustrate why these categories were created.

Table 5.22

Theme: Maintenance of and Importance of Teamwork in Medical Field	
Category:	
Feedback and Reflection	Improvement in this skills will come with each new group I join. The challenge will be to avoid becoming complacent in my skills which will involve constantly reviewing my interactions and how others react to what I am doing. ID33 I will continue ask for constructive feedback from others so that I will maintain high competency in this area. ID18 1. Ask for more positive/constructive feedback from my teammates so that I can improve our group functions 2. Learn to apply my new skills in further settings as we move forward in medical school 3. I will learn to reflect on my growths so that I can understand what need improvement and so that I can maintain this competency ID10

	I plan to maintain these skills by practicing them and asking other members of future teams or team leaders how they feel I contribute and what I could do better. ID33 I will ask for feedback to ensure that my teamwork skills are exceptional and ask for any suggestions for improvement. ID47
Take what I have learned forward	I will take these skills and competencies I have developed in lab this semester and implement them into other groups and teams that I am apart of in both classes and in other student organizations. I will know if I am achieving this goal from how smoothly and effectively the groups I am apart of run ID76 I plan to continue actively trying to get to know the members on future teams. I will try to schedule at least one outside of school/workplace get together in order to better facilitate this. ID28 I hope to use what I have learned about team work in future courses and when I start rotations. I know there will be many times where I will need extra support and I hope that building strong teams will allow me to overcome challenges and support my peers when they need assistance. ID31 I plan on continuing to practice the teamwork competency through the teams I am currently a part of, from study groups to club leadership. These activities require me to be reliable and do my part while working together with others to achieve a common goal that everyone can benefit from. ID77 Moving forward, I want to operate in trust when it comes to my colleagues. That's not to disregard situations where questioning my peers' decisions is necessary, however I want to trust first instead of being skeptical. ID9 I plan to continue using the leadership skills I have learned this semester and take them with me into the medical field. ID27
Importance of Teamwork as a medical professional	teamwork is always going to be a huge part of working in the medical field and this is definitely an area that will require consistent development. ID75 I think the doctor has to be the ultimate team player. It is essential to be not only a future doctor but a great one. ID66 Success in medical field is heavily depend on teamwork. In order to succeed I need to be a good team player and show a great deal of flexibility ID46 I want to make sure I am consciously making an effort to create a positive environment when I am a medical professional. To ensure this, I plan to regularly check up with my coworkers and make sure they are comfortable and happy with the environment that is within the workplace. ID27 I will maintain a good team atmosphere and although I will be the team leader as a physician, I will remain very approachable for suggestions on how the team could improve or how I, as team leader, could improve. ID47

Overall, three main themes emerged longitudinally across the students' Teamwork CDPs: Collaboration Skills, Team Engagement Skills, and Conflict/Problem Solving Skills. These themes and their prominent subthemes are depicted in Figure 5.3.

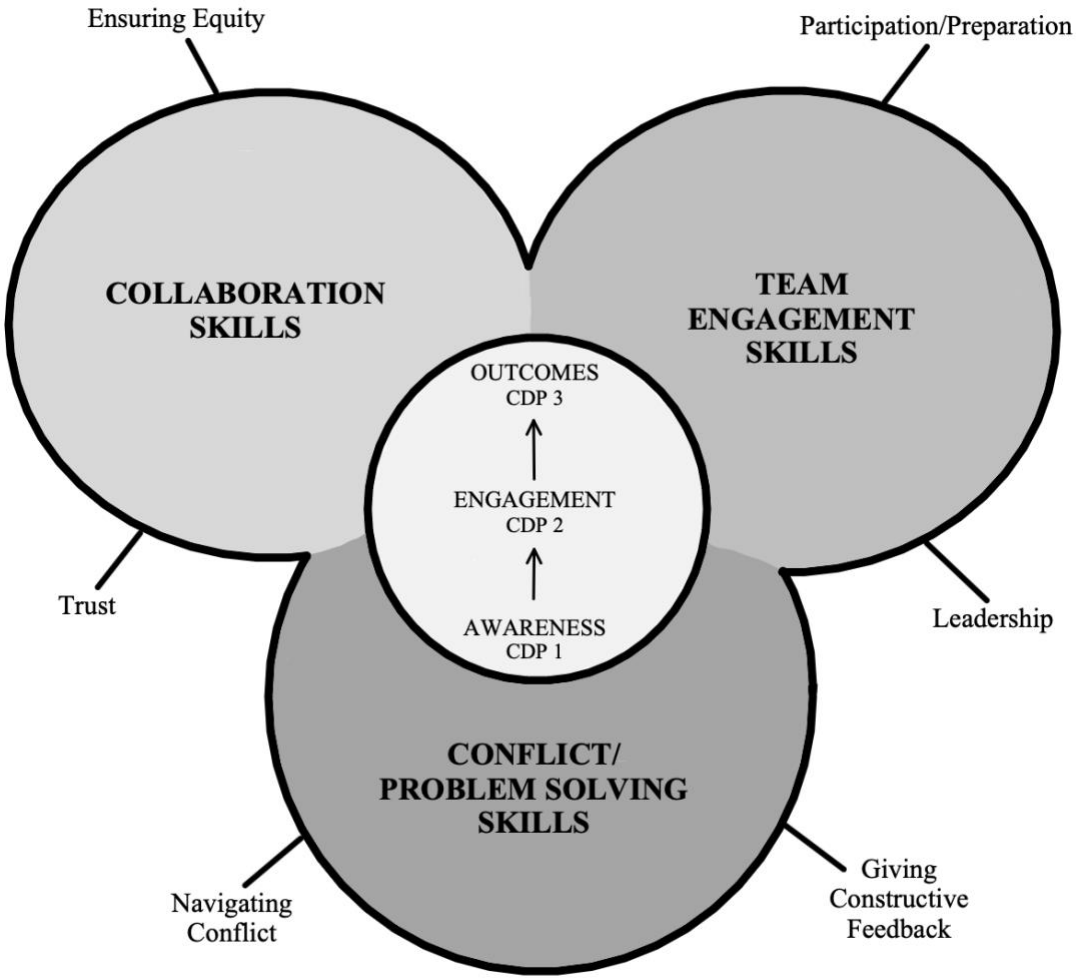

Figure 5.3. Teamwork Competency Development Themes and Subthemes

5.4. Discussion

This study used quantitative self- and peer-assessments along with qualitative self-authored longitudinal portfolio reflections to investigate teamwork competency development of first-year medical students in the gross anatomy lab context over time. The quantitative results indicated that first-year medical students at ULSOM self-assessed teamwork at a very high baseline level (>4.7) (Said, 2023) and they did not

exhibit statistically significant self-assessed growth from the beginning of the semester to the end of the semester (Table 5.4 and 5.5). The quantitative results also demonstrated that students assessed their peers at a very high baseline level (>4.8) (Said, 2023), and that assessment remained consistent with no statistical growth or decline from the beginning of the semester to the end of the semester (Table 5.7 and 5.8).

The qualitative results revealed three main themes that coursed throughout all three entries of the CDP over time: Collaboration skills, Team Engagement, and Conflict/Problem Solving skills. These themes involved many skills within the teamwork competency that students had personal strengths and weaknesses within and set goals for improving throughout the semester. They reflected on progression through those goals and stated how they believed they either were still working on or improved upon their skills within these themes since the beginning of the semester.

For students who discussed aspects of Collaboration skills, at the beginning of the semester there was a focus on their strengths and weaknesses in ensuring equity amongst their teams and supporting and encouraging teammates. Some students noted how they are strong at making sure there is equitable distribution of dissection tasks or roles within their teams, while others noted that being a weakness. These students set goals to make dissection duties more equal by switching off roles every so often and ensuring one teammate does not do all the hard work (Table 5.10). Students indicated strengths in being a supportive teammate and providing encouragement when team members do a good job on tasks. Some students who indicated they struggle with supporting and providing encouragement to teammates set specific goals to be a better teammate by praising their teammates for their successes and instilling confidence in them and being

considerate of their teammate's situations inside and outside of medical school (Table 5.10). Many students also indicated a belief of working well in teams due to coming from team-oriented backgrounds, being on sports teams prior to medical school, and overall being a "team player" (Table 5.10). Students also discussed using teammate feedback to improve their skills, like discussing with teammates how they feel about their involvement and ensuring they are contributing to the team's tasks fairly and meaningfully.

At mid-semester, students discussed how they had made efforts to share more responsibilities with their teams in the gross lab, but others noted that this was still an area that needed work within their teams. Students set goals to work on ensuring each teammate has adequate dissection time, being more proactive in asking teammates if they want or need to switch roles during dissection and making more effort to vocalize these responsibilities and roles with their dissection teams (Table 5.15). Several students also set new goals surrounding praising their peers, including giving words of affirmation and congratulations when team members find a certain structure or complete a difficult dissection task. Mainly, students made specific points as to how well their teams work together, with a transition from "I" statements regarding individual collaboration skills in CDP part one to "we" statements regarding collaboration skills in CDP part two. Students noted how their teams worked well together to distribute dissection duties and a general belief of good collaborative team dynamics (Table 5.15).

By the end of the semester, students who reflected on their Collaboration skills did so in one of two ways: individual progression in collaboration skills or team progression in collaboration skills. Those who had a belief of self-improved collaboration

skills discussed how they interpreted their skills had improved in delegating tasks for their teammates, in relying on others to perform tasks and becoming more comfortable completing tasks *with* others, and in expanding trust in their teammates (Table 5.18). Several claimed they believed they improved their personal teamwork skills due to the belief of how well their teams worked together. Those who discussed a belief of team-improved collaboration skills mainly discussed how their teams built *trust* and ensured team equity during dissections in lab. These students commented on how they believed they themselves *and* their peers had improved in delegating tasks and assuming and switching roles comfortably and becoming more competent and confident in the lab setting with more efficient dissection sessions (Table 5.19). Students discussed being able to rely on their teams inside and outside of the lab setting and building trust with teammates by celebrating their successes and building each other up when discouraged (Table 5.19).

For students who discussed aspects of Team Engagement, at the beginning of the semester there was a focus on team participation and leadership abilities. Students mentioned how they felt strongly in willingness to participate in a team and rely on others to traverse challenges, while some noted having little confidence in participating/initiating dissections with their teams (Table 5.12). An aspect of team participation that was mentioned was preparation, and how some students felt like if they were not adequately prepared for lab that they would bring the team down. These students set goals for wanting to be better prepared specifically for increasing their ability to contribute to their team environment, like when a teammate has a question or in discussing the dissection (Table 5.12).

Students also discussed leadership abilities and several students noted difficulty with relinquishing control in team settings. Some students noted that they are not natural leaders and instead engage with their teams in more of a background role, but the majority of students discussed how they tend to engage in the leadership role within a team setting and how that can be a strength and a weakness. Letting others take initiative and relying on others to complete tasks without taking over were the main weaknesses mentioned. These students created goals to work on not applying their personal standards to others, resist placing themselves in a self-appointed position of leadership, and allowing others to engage in activities that they usually prefer to do, like being the lead dissector (Table 5.12).

By mid-semester, there was a shift within the Team Engagement theme to students mainly discussing aspects of participation and preparation, team bonding, and using their teammates as learning tools. Students discussed how they had worked on initiating more conversations with their teammates and contributing more during dissections, while others noted still struggling with contributing to their teams due to lack of preparation. These students set goals for the remainder of the semester to improve their participation within their teams by preparing more ahead of time by reviewing lecture material and creating lab notes and bringing those to lab sessions to help contribute to the team (Table 5.16).

Some students created new goals surrounding team bonding, like wanting to spend more time outside of lab sessions with their teams to create a stronger team bond, to ensure that their teammates are excelling in all parts of the lab and connect more with their teammates to make lab more enjoyable (Table 5.16). Other students noted how they

realized they could use their teammates as learning tools in the lab setting by gathering their points of view rather than solely relying on oneself, asking each other questions and quizzing each other on dissection content to make sure each team member has mastered content equally (Table 5.16). While not as prevalent as the other categories in CDP part two, there were students who reflected on how they believed they had improved as a leader by taking more initiative within their teams and not dictating every move of their team members. Others noted how they could do a better job of stepping up more as a leader to help balance their team's teamwork (Table 5.16).

At the end of the semester, students discussed how their Team Engagement skills had progressed individually and at the team level. For students who discussed their individual progression, they noted how their teamwork skills improved because they intentionally got to know their teammates over the course of the semester by learning more about how they each learn and work most effectively. They also indicated a belief of improved leadership abilities by learning how to encourage others to step up, becoming more confident in the role of lead dissector, and relinquishing control and allowing others to take initiative. For example, one student stated "I have been known in the past to be a control freak, and assert myself as a leader amongst peers that are meant to be equals. I think I have done a much better job in allowing others to take charge" (Table 5.18). For students who discussed their team's progression, they used "we" statements to indicate how their teams' chemistry grew over the course of the semester, that they started understanding each other as people and how that contributed to their teams, how they had made time for each other outside of the lab setting, and how learning

each other's strengths and weaknesses contributed to working better as a team (Table 5.19).

For students who discussed the theme of conflict/problem solving skills, at the beginning of the semester there was a significant focus on strengths and weaknesses in navigating conflict, giving constructive feedback, and mediation skills. Many students noted their discomfort with or tendency to avoid conflict, while others claimed they are good at easing tensions within a team atmosphere, being a good mediator, and being able to give and take constructive criticism (Table 5.11). These students set goals to develop better abilities to give constructive feedback to peers and to improve their confrontation and conflict skills by speaking up if a conflict does occur within their team.

By mid-semester, students did not discuss conflict/problem solving as much as they did in CDP part one. This seemed to be due to a general lack of conflict amongst teams. Students noted that situations had not arisen yet that would require speaking up to mediate. Several students noted that they had set goals to be better at speaking up during disagreements, but that there had been limited or no disagreements amongst their teams throughout the semester thus far (Table 5.17). At the end of the semester, students who reflected on conflict/problem solving skills recognized it as an area that still needed to be improved upon as they move forward in their medical education. Students noted that they had worked on their abilities to provide constructive feedback but that that was still an ability that could be worked on further (Table 5.20). One student recognized that "An aspect of the teamwork competency I could still improve in would be confronting conflict, because this wasn't really an issue that arose with my team and thus this is one

aspect of teamwork I didn't really practice, although it will be an important skill to have in future teams I will be a part of" (Table 5.20).

These results from the quantitative and qualitative methods were triangulated to determine if convergence occurred or if discrepancies were observed between data sets. Methodological triangulation was useful and necessary to address multiple aspects of the same phenomenon--Teamwork competency development over time in the gross anatomy lab context. This triangulation aimed to address the following questions:

- Do first-year medical students exhibit statistical growth over time? If so, how? If not, why? (*Quantitative results + Qualitative results/discussion)*
- What skills do students already possess in this competency, what skills did they believe they gained or improved upon? (*Qualitative results/discussion)*
- How do students feel about their progression in the competency? (*Qualitative results/discussion)*

The quantitative assessments provided static snapshots of students' teamwork skills and the opportunity to determine if growth was self- and/or peer-perceived on the TPS, while the open-ended qualitative portfolio entries furnished the opportunity for longitudinal exploration of student perspectives on their progression through behavioral attributes of teamwork in the gross anatomy lab context.

The quantitative aspect of this study demonstrated that first-year medical students at the ULSOM did not exhibit statistically significant growth from TPS-SA-1 to TPS-SA-2 (p = .009) or from TPS-PA-1 to TPS-PA-2 (p = .055). There are several reasons why these findings may have occurred. At the beginning of the semester, students mentioned

weaknesses in conflict/problem solving skills, and as they progressed through the semester there was less discussion of conflict/problem solving skills, with some students noting how they had not experienced any conflicts within their teams and therefore were not working on those skills (Table 5.11 and 5.17). Even though students stopped talking as much about these skills in CDP entries two and three, it is probably because students did not know how or did not want to set further goals to address these skills due to a perceived lack of conflict in their teams. In CDP entry three, students recognized needing to work on giving teammates constructive feedback and knowing that conflict within teams can and will occur in their future, indicating that they still had progress to make within this aspect of the competency (Table 5.20). Within the Conflict/Problem Solving theme discussed in the CDPs, it is clear that significant progress was not indicated by students, which is consistent with the quantitative results.

Within the Collaboration and Team Engagement themes present in both the CDPs and TPS, students mainly discussed and set goals surrounding establishing roles within their teams, being supportive, encouraging teammates, and actively participating in their teams. Many students also indicated that teamwork was already a strength due to being on sports teams or working in other team settings prior to entering medical school (Table 5.10) which resulted in students ranking themselves (M = 4.70) and their peers (M = 4.81) very highly (Said, 2023) on the TPS early in the semester. Students likely had a superficial understanding of what it means to be on a collaborative learning-team as they were assessing themselves and their peers at the beginning and at the end of the semester. Collaboration is a complex entity, Griffiths et al. (2020) describe a “building blocks” model of collaboration emphasizing that the initial building blocks are developed and

cultivated before additional blocks can be added. Relationship building, including the establishment of mutual respect, open communication, and trust, is at the base level of the building blocks of collaboration (Griffiths et al., 2020). Students described how over the course of the semester they had built trust within their teams, developed strong relationships with their teammates, and established roles during dissection duties. However, this indicates these students were just beginning to develop collaborative skills and did not progress to more complex aspects of collaboration like shared values, beliefs, and goals amongst the team (Griffiths et al., 2020).

Some students began to discuss shared values and beliefs when they transitioned from using "I" statements in CDP part one, to "we/our" statements in CDP parts two and three. However, these students still maintained a superficial understanding of collaboration and team engagement by focusing on general beliefs of good collaborative team dynamics and that they themselves and their teammates had just improved in delegating tasks and assuming/switching roles during dissection sections and did not discuss how their teams had developed shared common goals or how they worked *together* for decision making toward common goals. This could describe why the Collaboration items on the TPS-SA such as "Recognizing my team members when something they say helps the team reach a good decision" (M = 4.89 to M = 4.89) and "Encouraging team members to express their thoughts and opinions" (M = 4.78 to M = 4.77), remained stagnant.

Within Team Engagement, several students mentioned at the beginning of the semester how they felt strongly in their willingness to participate in a team, and by the end of the semester they were discussing *how* they had successfully participated in their

teams due to improved leadership abilities and individual preparation prior to lab sessions. However, in the third tier of the collaboration building blocks, active engagement, describes how shared responsibility (Griffiths et al, 2020) is a more appropriate way to approach team scenarios rather than an individual establishing "leadership". This could explain why there was stagnancy and even slight decline from the beginning of the semester to the end of the semester on TPS-SA engagement items such as: "Willingly participates in all relevant aspects of the team" (M = 4.89 to M = 4.86), "Attentive to what other team members say when they speak" (M = 4.92 to M = 4.90), and "Consistently pays attention during group discussions/dissections" (M = 4.82 to M = 4.82). This indicates further clarification and development of what it means to be a collaborative, engaged teammate is needed for first-year medical students in the gross anatomy lab context.

Overall, even with some of the TPS items indicating growth, several indicated stagnancies resulting in insignificant *t*-tests. While the TPS captures many teamwork skills, students discussed aspects in their CDPs that were not directly measured in the TPS (leadership abilities, role establishment in teams, etc.). Students discussing these aspects in their CDPs gives a more holistic picture of what students believe are the important aspects of teamwork in the gross anatomy lab context, which will further influence curriculum development for assessment of the teamwork competency.

It was anticipated that students would discuss their ATCs more in their CDPs and how (if at all) they contributed to teamwork skill development, but they did not. Therefore, while the ATC was a useful tool to establish ground rules amongst teams, it may not have been enough of an intervention to truly increase levels of teamwork skills

to be perceived by peers and individually. This suggests the need for other educational interventions within the gross anatomy lab context to provide training for teamwork skills such as equitable distribution of tasks, shared responsibility rather than leadership, and conflict/problem management.

CHAPTER 6

A MIXED METHODS ANALYSIS OF FIRST-YEAR MEDICAL STUDENTS' PROFESSIONALISM COMPETENCY DEVELOPMENT IN THE GROSS ANATOMY LABORATORY CONTEXT

6.1. Introduction

Professionalism is one of the six general competencies endorsed by the ACGME and ABMS that is used to evaluate medical residents and reflects a skill necessary of a practicing physician (Kavic, 2002). The AAMC, AACOM, and ACGME are currently sponsoring an initiative to develop a common set of foundational competencies for use in UME programs within the United States as a comprehensive effort to improve medical students' transition to residency (*Foundational,* 2024). Professionalism will be reflected within these foundational competencies, which will intend to represent minimum competencies for all medical students, regardless of degree type or eventual specialty of practice (*Foundational,* 2024). The ULSOM is already including Professionalism Skills and Personal and Professional Development as two of the core competencies within the school of medicine program objectives which all graduates should be able to demonstrate by graduation. Within these competencies, graduates should be able to exhibit behaviors of professionalism required for working in a stressful and team-oriented environment; form a healthy professional identity that adheres to the standards of the medical profession, including respect for all persons, compassion and empathy, trustworthiness, and integrity; set and revise personal and professional development goals based on

participation in formal self-assessment and periodic reflection activities; and, establish effective work habits, including organized and timely completion of required duties and assignments, etc. (*School of*, n.d.).

The AAMC Professional Task Force defined medical professionalism as "the enactment of the values and ideals of individuals who are called, as physicians, to serve individuals and populations whose care is entrusted to them, prioritizing the interest of those they serve above their own" (Escobar-Poni & Poni, 2006). The preclinical years of medical education can provide the foundational professionalism and ethics necessary to continue medical training, and the gross anatomy lab with cadaveric dissection offers a unique opportunity for first-year medical students to confront their "first patient" (Escobar-Poni & Poni, 2006; Palmer et al., 2020). Dissection-based gross anatomy labs provide implicit skills to develop basic elements of professionalism that are assessed during clinical years of medical education, but these skills must be recognized and taught in order to be evaluated (Escobar-Poni & Poni, 2006). It has been determined that no individual tool is able to reliably and effectively measure students' professionalism; rather, a multi-tool approach should be used due to the situational and complex nature of professionalism (Hoffman et al., 2017; Palmer et al., 2020).

We agree with Escobar-Poni and Poni (2006) and Palmer et al. (2020) and suggest the gross anatomy laboratory with dissection-based learning as an opportune venue to implement Professionalism skills competency assessment during the first year of UME using self- and peer-assessments and reflective portfolio pieces. This study will demonstrate how the professionalism competency is inherently present in the gross anatomy lab context, how it can be successfully incorporated into the gross anatomy lab

dissection-based curriculum, and how assessing first-year medical students in this competency and in this context is feasible.

This phase of our mixed-methods investigation of competency development is intended to 1) quantitatively determine whether first-year medical students' self-assessments of the Professionalism competency in the gross anatomy lab context exhibit change over time, 2) quantitatively determine whether first-year medical students' peer-assessments of the Professionalism competency in the gross anatomy lab context exhibit change over time, 3) qualitatively analyze and contextualize student reflections on their baseline status, progress, and development of their Professionalism competency throughout the gross anatomy course.

6.2. Materials and Methods

Overview of Methodology

This study was conducted under a convergent parallel mixed methods design (Figure 3.1.). The quantitative phase utilized a pretest/posttest design using the Professionalism Assessment Scale (PAS) (Hammer et al., 2000). The continuous day-to-day activities and experiences in the gross anatomy laboratory (e.g., showing up to lab on time, behaving in accord with ethical principles, care and treatment of cadaveric donors) over the course of the semester were considered the interventions for the professionalism competency which occurred between the pre and posttests. The qualitative phase used student competency development portfolios (CDPs) developed for the competency-based curriculum in the CADE course at ULSOM as data materials. These portfolio entries were thematically analyzed using coding and grounded theory to describe how students perceive the development of their Professionalism competency over the CADE course.

The results from each phase of the study were then triangulated to give a holistic description of first-year medical student professionalism competency development over time in the gross anatomy lab context.

Quantitative Materials and Methodology

First-year medical students at ULSOM in the fall of 2022 completed quantitative self- and peer-assessments of professionalism skills using the previously validated 25-item Behavioral Professionalism Assessment, the Professionalism Assessment Scale (PAS) adapted from Hammer et al., 2000 at the beginning and at the end of the gross anatomy course (n = 83). The PAS was developed as an instrument to assess behavioral professionalism of pharmacy students (Hammer et al., 2000). The PAS was found to be psychometrically sound based on measures of internal consistency (Cronbach's α = .973), factor analysis, and interscale correlations when used with pharmacy preceptors and their students participating in experiential rotations (Hammer et al., 2000). The PAS assesses specific behavioral attributes of Professionalism under four main domains: Interpersonal Relations/Social Skills, Responsibility, Professional Communication, and Appearance. The researchers claimed that the instrument should be tested in other professional education environments to strengthen external validity, and that none of the scale items, if deleted from the instrument, would drastically reduce the overall Cronbach's α of .973 (Hammer et al., 2000). We adapted the 25-item PAS to a 24-item PAS to assess first-year medical students' professionalism skills in the gross anatomy lab context. The PAS for the gross anatomy lab context consists of 24 items scored on a Likert scale anchored by 1 (unsatisfactory) and 5 (excellent). Self-assessment (PAS-SA-1

and PAS-SA-2) and peer-assessment (PAS-PA-1 and PAS-PA-2) versions were created and can be found in Appendix D.

The quantitative phase of this study included several statistical analyses including an internal reliability assessment of the PAS-self-assessments and PAS-peer-assessments, dependent paired samples *t*-tests of the self- and peer-assessment data, and measures of effect size. Data were analyzed within SPSS version 29.0, with a Bonferroni adjusted significance level of $p \leq .0083$. Before conducting any statistical analyses, the data were examined to ensure that the assumptions of the statistical tests were met.

Gross Anatomy Lab Setting

At the start of the CADE course, first-year medical students were assigned to a cadaveric donor at a table within a zone in the gross anatomy lab. There were 28 tables utilized for medical gross anatomy in the fall 2022. Six to seven students were assigned to each donor, and those six to seven students were further subdivided into teams of three to four students, represented by groups A and B. The students were in these A and B teams all semester long at the same table and with the same cadaveric donor, and they alternated dissection days throughout the semester (30 lab sessions total). At the beginning of the semester, after only dissecting together once or twice, these teams of three to four students were asked to self-assess themselves, and peer-assess their two to three dissection teammates using the PAS-SA-1 and PAS-PA-1. At the end of the semester, the dissection teams were asked to self-assess themselves and peer-assess their two to three dissection teammates using the PAS-SA-2 and PAS-PA-2.

Qualitative Methodology

The students completed three competency development portfolio (CDP) assignment entries throughout the CADE course (n = 83). The first entry at the beginning of the semester asked students to reflect on their strengths and weaknesses within the Professionalism competency and to develop SMART goals for the competency. The second entry at mid-semester asked students to reflect on and track their progress in the Professionalism competency thus far and to revise or set new goals in the competency for the remainder of the semester. The third entry at the end of the semester asked students to reflect on their progression in the Professionalism competency throughout the semester and to make a plan for how they will continuously maintain and improve their skills in the competency as it relates to the medical field (Appendix E).

Thematic analysis and grounded theory principles were used to qualitatively analyze the students' responses in their CDPs in the qualitative data analysis software MaxQDA version 22.5.0. Students' CDP part one entries were initially read, then coded, and then axially coded to find the main themes, and categories within those themes, present in first-year medical students' strengths and weaknesses and goals set within the Professionalism competency at the beginning of the semester. Students' CDP part two entries were then read, coded, then axially coded to find the main categories and themes present in students' progress in and reflections on their Professionalism competency goals set at the beginning of the semester. Students' CDP part three entries were then read, coded, and axially coded to find the main categories and themes present in the students' summative reflection on their overall development within the Professionalism competency over the CADE course.

CDP entries were coded until it was determined that thematic saturation was reached for the main categories and themes that erupted from the data during constant comparison of the dataset. Once this coding process was complete, selective coding across all created categories was used to determine the most common themes and categories students discussed within their teamwork competency development over the CADE course. These themes and their categories were then used to generate theories and propositions that describes the interrelationship of the themes and categories to describe student perceptions on teamwork skill development in the gross anatomy lab context over time.

6.3. Results

Reliability Analyses

A Cronbach's α reliability analysis with an Intraclass Correlation Coefficient (ICC) confidence interval estimate was conducted to measure the internal consistency of the scale items on each version of the PAS. Cronbach's α and ICC estimates and their 95% confidence intervals were calculated using SPSS version 29.0 based on a 2-way mixed-effects model (Bravo & Potvin, 1991; Koo & Li, 2016). For the PAS-SA-1, the obtained ICC/α value is .875 (indicating good reliability), its 95% confidence interval ranges between .833 and .911, meaning that there is a 95% change that the true α value lands on any point between .833 and .911. Based on statistical inference, it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li., 2016). For the PAS-SA-2, the obtained ICC/α value is .918 (indicating excellent reliability), its 95% confidence interval ranges between .891 and .942. Based on statistical inference, it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li,

2016). For the PAS-PA-1, the obtained ICC/α value is .901 (indicating excellent reliability), its 95% confidence interval ranges between .878 to .922. Based on statistical inference it is more appropriate to conclude its level of reliability to be good to excellent (Koo & Li, 2016). For the PAS-PA-2, the obtained ICC/α value is .924 (indicating excellent reliability), its 95% confidence interval ranges between .906 and .939. Table 6.1 illustrates these results.

Table 6.1

Cronbach's Alpha and ICC results for the PAS

	Cronbach's Alpha	Intraclass Correlation	95% Confidence Interval		N of Items
			Lower Bound	Upper Bound	
PAS-SA-1	.875	.875	.833	.911	24
PAS-SA-2	.918	.918	.891	.942	24
PAS-PA-1	.901	.901	.878	.922	24
PAS-PA-2	.924	.924	.906	.939	24

Scale Items & Statistics

Table 6.2 and 6.3 illustrate the items on the PAS and their respective descriptive statistics.

Table 6.2

Item Statistics for PAS-SAs

	PAS-SA-1		PAS-SA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
Student is reliable and dependable	4.80	.435	4.88	.363	83
Student produces quality work	4.48	.687	4.77	.423	83
Student is empathetic	4.92	.320	4.90	.297	83

Student behaves in an ethical manner	4.93	.261	4.92	.280	83
Student communicates articulately	4.54	.570	4.71	.456	83
Student is punctual	4.84	.427	4.82	.417	83
Student uses time efficiently	4.71	.530	4.83	.408	83
Student is self-directed in undertaking tasks	4.71	.482	4.81	.397	83
Student maintains confidentiality	4.94	.239	4.92	.280	83
Student is respectful	4.95	.266	4.95	.215	83
Student communicates using appropriate body language	4.87	.341	4.90	.297	83
Student demonstrates accountability	4.92	.280	4.92	.280	83
Student prioritizes responsibilities effectively	4.76	.458	4.86	.354	83
Student accepts and applies constructive criticism	4.81	.426	4.82	.417	83
Student puts others' needs above their own	4.71	.482	4.76	.430	83
Student is nonjudgmental	4.92	.280	4.84	.366	83
Student communicates assertively	4.55	.685	4.72	.477	83
Student is an active learner	4.81	.397	4.90	.297	83
Student is cooperative	4.95	.215	4.95	.215	83
Student is diplomatic	4.92	.280	4.86	.387	83

Student "follows through" with responsibilities	4.87	.341	4.90	.297	83
Student wears appropriate attire	4.94	.239	4.96	.188	83
Student demonstrates confidence	4.61	.559	4.69	.583	83
Student demonstrates a desire to exceed expectations	4.61	.601	4.72	.450	83

Table 6.3

Item Statistics for PAS-PAs

	PAS-PA-1		PAS-PA-2		
	Mean	Std. Deviation	Mean	Std. Deviation	N
Student is reliable and dependable	4.88	.359	4.94	.283	169
Student produces quality work	4.80	.483	4.90	.339	169
Student is empathetic	4.91	.285	4.91	.342	169
Student behaves in an ethical manner	4.93	.300	4.97	.170	169
Student communicates articulately	4.83	.450	4.93	.280	169
Student is punctual	4.87	.483	4.83	.496	169
Student uses time efficiently	4.91	.332	4.93	.280	169
Student is self-directed in undertaking tasks	4.83	.484	4.89	.379	169
Student maintains confidentiality	4.99	.108	4.99	.077	169
Student is respectful	4.94	.261	4.96	.186	169

Student communicates using appropriate body language	4.95	.213	4.96	.186	169
Student demonstrates accountability	4.93	.270	4.96	.265	169
Student prioritizes responsibilities effectively	4.91	.349	4.93	.280	169
Student accepts and applies constructive criticism	4.89	.363	4.92	.289	169
Student puts others' needs above their own	4.80	.454	4.87	.402	169
Student is nonjudgmental	4.94	.237	4.94	.261	169
Student communicates assertively	4.83	.476	4.94	.261	169
Student is an active learner	4.90	.321	4.95	.239	169
Student is cooperative	4.96	.186	4.96	.200	169
Student is diplomatic	4.92	.309	4.96	.228	169
Student "follows through" with responsibilities	4.92	.297	4.96	.215	169
Student wears appropriate attire	4.99	.108	4.99	.077	169
Student demonstrates confidence	4.83	.500	4.86	.440	169
Student demonstrates a desire to exceed expectations	4.77	.476	4.92	.335	169

Quantitative: PAS-self-assessments dependent t-tests

The PAS-self-assessment was utilized at pretest (PAS-SA-1) and sought to measure self-assessed levels of professionalism skills at the beginning of the semester. The PAS-self-assessment was utilized again at posttest (PAS-SA-2) and sought then to measure change in self-assessed levels of professionalism skills from the beginning of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the PAS-self-assessment was utilized to determine whether change is self-perceived by first-year medical students. A paired samples *t*-test is most appropriate because the data were collected from the same group of students at two different time points (n = 83).

There was no statistical difference in PAS-self-assessment scores from Time 1 (*M* = 4.81, *SD* = .209) to Time 2 (*M* = 4.85, *SD* = .217), *t* (82) = -1.623, *p* = .108 (two-tailed). The mean difference in PAS-self-assessment scores was .034 with a 95% confidence interval ranging from -.075 to -.008. Cohen's D, a measure of effect size, showed a small effect (.1895). Tables 6.4-6.6 and Figure 6.1 illustrate these results.

Table 6.4

Paired Samples Statistics for PAS-SAs

	Mean	N	Std. Deviation	Std. Error Mean
PAS-SA-1	4.81	83	.209	.023
PAS-SA-2	4.85	83	.217	.024

Table 6.5

Paired Samples Test for PAS-SAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
PAS-SA-1 to PAS-SA-2	-.034	.190	.021	-.075	-.008	-1.623	82	.108

Table 6.6

Paired Samples Effect Sizes for PAS-SAs

			Point	95% Confidence Interval	
		Standardizer[a]	Estimate	Lower	Upper
PAS-SA-1 - PAS-SA-2	Cohen's d	.1895	-.178	-.394	.039

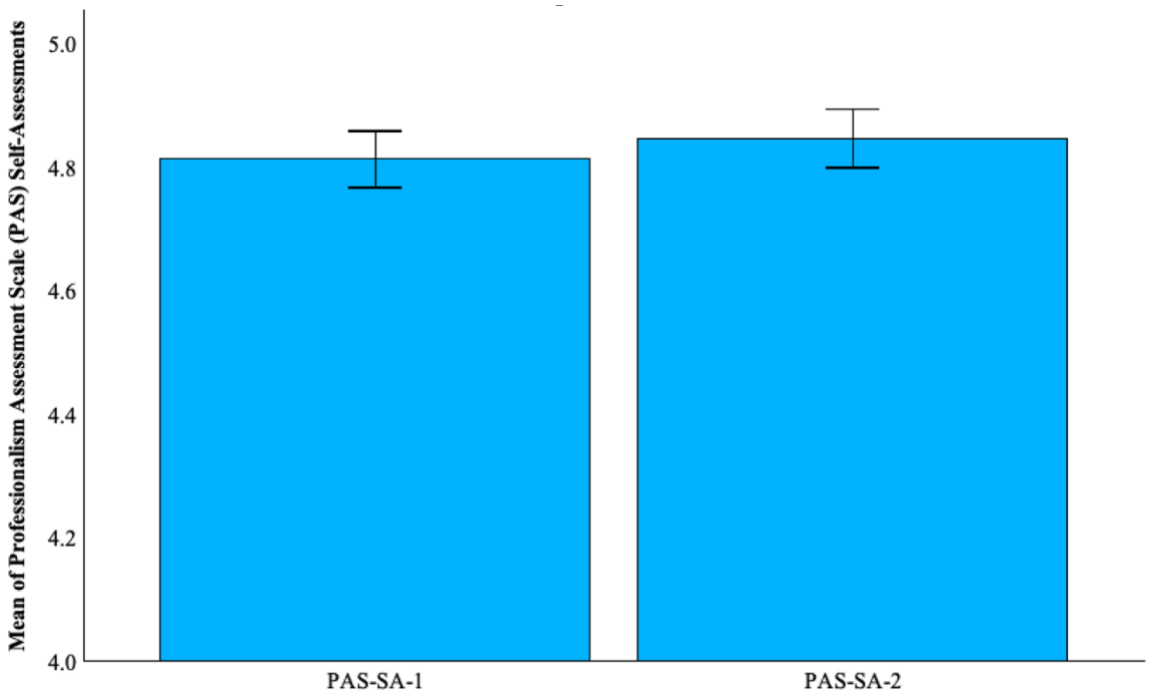

Figure 6.1. Professionalism Assessment Scale Self-Assessments

Quantitative: PAS-peer-assessments

The PAS-peer-assessment was utilized at pretest (PAS-PA-1) and sought to measure levels of professionalism skills of peers at the beginning of the semester. The PAS-peer-assessment was utilized again at posttest (PAS-PA-2) and sought then to measure a change in levels of professionalism skills of peers from the beginning of the semester. A dependent paired samples *t*-test on the pretest/posttest data for the PAS-peer-assessment was utilized to determine whether change is peer-perceived by first-year medical students. A paired samples *t*-test is most appropriate because the data were collected from the same group of students' peer-assessing the same group of students at two different time points (n = 83).

There was a statistically significant increase in PAS-peer-assessment scores from Time 1 (M = 4.89, SD = .165) to Time 2 (M = 4.93, SD = .127), t (82) = -2.890, p = .005 (two-tailed). The mean difference in PAS-peer-assessment scores was .040 with a 95% confidence interval ranging from -.068 to -.012. Cohen's D, a measure of effect size, showed a negligible effect (.127). Tables 6.7-6.9 and Figure 6.2 illustrate these results.

Table 6.7

Paired Samples Statistics for PAS-PAs

	Mean	N	Std. Deviation	Std. Error Mean
PAS-PA-1	4.89	83	.165	.018
PAS-PA-2	4.93	83	.127	.014

Table 6.8

Paired Samples Test for PAS-PAs

	Paired Differences							Significance
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Two-sided p
PAS-PA-1 to PAS-PA-2	-.040	.127	.014	-.068	-.012	-2.890	82	.005

Table 6.9

Paired Samples Effect Sizes for PAS-PAs

				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
PAS-PA-1 - PAS-PA-2	Cohen's d	.127	-.317	-.537	-.096

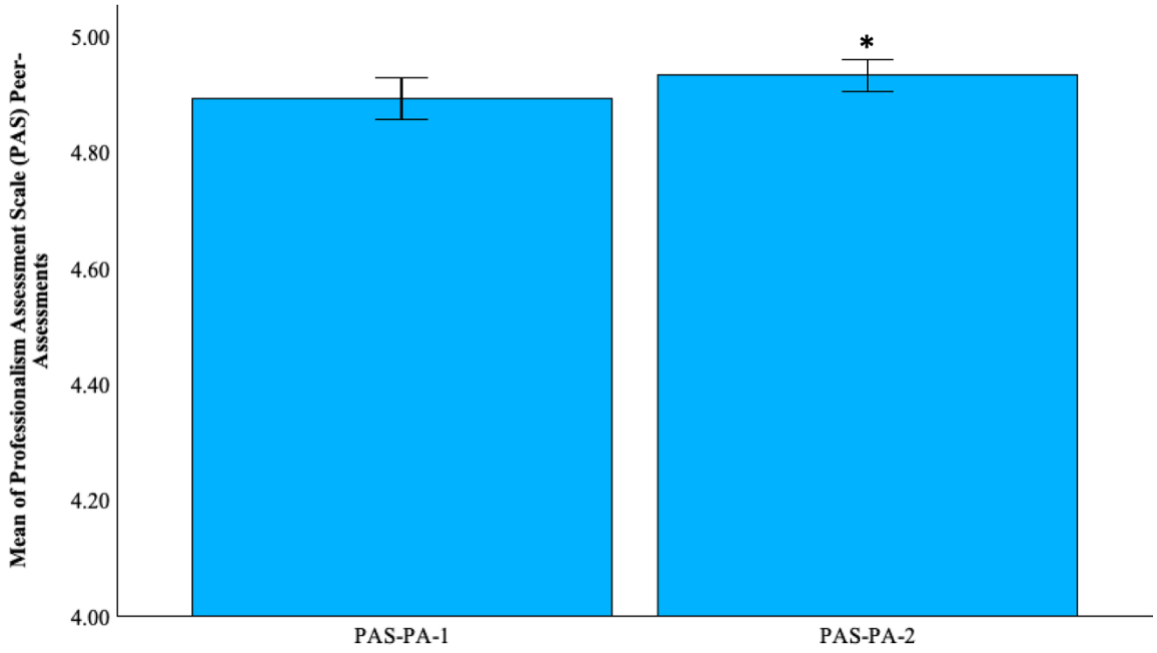

Figure 6.2. Professionalism Assessment Scale Peer-Assessments

Qualitative Results

Thematic analysis with principles of grounded theory was utilized to examine student reflections on their baseline status and goal setting, progress, and development within the Professionalism competency during the CADE course. The goal of this analysis was to explore and contextualize the personal experiences students had whilst developing their professionalism competency skills during the CADE course.

Baseline Status and Goal Setting

In CDP part one, students were asked to reflect on their self-perceived strengths and weaknesses in the professionalism competency as well as to set SMART goals for improving their skills in their professionalism competency over the CADE course. The major theme of CDP part one involved strengths, weaknesses, and goals surrounding Interpersonal Relations/Social Skills. Here, students mainly discussed aspects of professionalism such as respect for teammates, peers, and others' time; being honest with self and teammates; accountability; and weaknesses in addressing unprofessionalism of others. Students also discussed their general belief of already feeling "strong" in the professionalism competency by knowing when to act professionally and holding the self and others to a high professional standard. Table 6.10 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.10

Theme: Interpersonal Relations/Social Skills in Professionalism		
Category:		
	Strength or Weakness	Related Goals
Respect	I feel that I am effective in making everyone I interact with feel respected to ensure that we can work in a healthy professional environment. ID47 Strength: respect -- respect for the donors, others' time, and the contributions of my teammates ID60 A strength I have in professionalism is showing respect to my teammates by listening before speaking, always making eye contact, never raising my voice with anyone. ID64 I always treat my colleagues with respect. ID58 A strength of mine when it comes to professionalism is treating my team members with respect and making sure that I listen to them and consider what they are saying. ID53 My areas of weakness include not always giving my sole attention to someone when they are talking to me. ID9 Weakness: I have a tendency to interject a lot of my ideas even when my other colleagues are speaking. ID4	Stop what I am doing and give full eye contact to the person that is talking to me ID9 Another goal I have is to be honest with both myself and my teammates. I will immediately speak up if I don't feel comfortable proceeding in a dissection, or if I feel lost or struggling. ID64 I also want to work on admitting to my mistakes and speaking up if a mistake is made so that others can also help, but also trying my hardest to not make mistakes in the lab. ID27 Owning up to minor mistakes that I have made. a. While I am okay at owning up to major mistakes that would change the course of our dissection, I am poor at owning up to minor mistakes i.e. having accidentally nicked an artery or vein for example. b. Achieving the Goal i. Making the concentrated effort to dictate my dissection moves to my peers whilst dissecting. c. Success Measures i. Peers verbally indicate that we understand which cuts were made after each dissection and that we know which minor mistakes (important or not) were made by whom. ID55 When I see something particularly challenging with a dissection I will pause before speaking, take a deep
Subcategory: Honesty/ Accountability	My biggest strength concerning professionalism is my honesty and the respect I show others in my professional environment. I enjoy my teammates and fellow classmates so much, respecting everyone has not been a challenge for me in the slightest. I feel as though I come to lab each time and show the upmost respect to the other students at that table. ID16	

	Areas of Weakness: • Acknowledging when I have made a minor mistake ID55 One of my weaknesses in this competency is that I am often very worried about messing up. This leads to not speaking up if I feel that I've made a mistake and just trying to fix it on my own. ID27 Weakness: honesty of knowledge -- be more upfront if I don't know what's going on ID60 I have a deep value for honesty and integrity. I am respectful of other's time ID14 I have absolutely no issue admitting to making mistakes ID81 Strength: Punctuality, respect and accountability ID37	breath, and then express my concerns to my peers. ID31 I will always be respectful and responsible. To know that I am successful, I will always be on time, know what's going on, and take responsibility if I'm at fault. ID3
Peer-to-Peer Professionalism	Weakness: I think I can sometimes lack professionalism when around my peers. ID28 My weakness is avoiding conflict and not taking prompt action if a colleague is acting unprofessionally. ID20 An area of weakness I have in professionalism is that I sometimes feel the need to vent to others when I am having problem with a teammate, instead of politely confronting said teammate correctly. ID64 Weakness- it's easy to lose sight of the task at hand because working with peers and hanging out with friends is a fine line ID35 I uphold my classmates to the same standards of professionalism. ID81 A weakness of mine is addressing someone when they are being disrespectful. ID69	Goal: To take account of others' unconscious biases by being more observant of their behavior and also taking prompt action against unprofessionalism I am an introvert and sometimes it is hard for me to step out of my comfort zone to address unprofessionalism. ID10 If a situation does arise where I need to take prompt action of a colleague acting unprofessionally, I will do so in a respectful manner. I can attempt to achieve this goal by first establishing a strong relationship with my colleague, so the colleague knows I am correcting or confronting them for their best interest. I will know if I reach this goal if the colleague understands how they acted unprofessionally after our interaction and does not make the same mistake again. ID20 Through the rest of the semester in CADE, I will continue to uphold

	I believe I may be weaker in upholding my teammates/peers to professional standards in terms "inappropriate" of comments being made during the dissection. ID61 I have failed to address a few comments made by peers that seemed disrespectful to an anatomical donor. ID58 Weaknesses: taking prompt action towards unprofessionalism ID10	the same standard of professionalism I have upheld until this point and also will encourage other people in my team to uphold that same standard as well. ID66 My goal for the professionalism competency is to continue showing up on time and to speak up if I feel that someone isn't acting professionally. ID27
Feeling “strong” in Professionalism	I feel that I am strong in professionalism. ID47 I feel that I possess many of the characteristics of a professional. Medicine is something I am truly fascinated with and passionate about so professionalism is something that comes naturally with the field since I take it so seriously. ID81 Strengths: Maintaining professionalism and appropriating it into the correct time and place, like a filter so to speak, has been a strength of mine. It helps isolate work and life to maintain mental health and practice professionalism in proper settings ID54 overall, i am very competent in my skills and my ability to respect others and act in a professional environment. ID38 I am always able to tell when it is time to act professional and can act in a way that exemplifies those qualities ID34 Strength: I enjoy following rules, so I have no problem adhering to the rules of professionalism. ID28	

The second theme discussed in CDP part one was Responsibility skills. Here, many students discussed their time management and organizational skills, whether or not they struggled with punctuality and wanting to arrive earlier to scheduled lab times. Being on time was the most commonly mentioned professionalism strength of the entire CDP part one. Table 6.11 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.11

Theme: Responsibility Skills		
Category:		
	Strength or Weakness	Related Goals
Time Management	My biggest weakness regarding professionalism is punctuality. I have always been a person that runs 5-10 minutes late, and in medical school that is no longer acceptable. I want to ensure I am managing my time wisely and show up to every lab on time ready to work. ID16 Weakness: Tardiness on occasion. ID50 weakness - showing up right when lab starts ID19 Areas of Weakness: Showing up early to lab ID55 Strength: I am always early ID31 Strength: being on time and ready to work for the day. ID44 Strength: I am able to be present and on time for required events such lab. ID4 I am a punctual people and believe that arriving early is a way that I can show respect to my group and the professors. ID22 Strength: Punctuality ID37 strength: showing up on time for lab ID46 Strengths: Arriving on time ID70 My areas of strength include showing up on time and being responsible. ID9 I feel like my biggest strength within this competency is showing up on time and being ready to go. I hate being late so I always try to be in lab at least 15 minutes early. ID27	I would like to arrive in the lab at least 10 minutes before lab starts to help my group members open/set up. I will do this by leaving my house earlier. ID19 My goal for professionalism is to improve my punctuality. I will measure this by ensuring that I am on time for every single lab, class, meeting, etc. This means showing up at least 5-10 minutes before each of these things are scheduled to start! ID16 Coming to lab at least 15 minutes prior to start rather than right as lab starts. a. While I am never late, I would like to push myself to be early. b. Achieving the Goal i. Working each time that I am scheduled in lab to walk into lab prepared at least 15 minutes prior to the start of lab. ID55 Going forward, I would like to arrive 15-20 minutes early to everything that I do to convey the upmost respect for my peers and superiors in addition to reducing my own stress ID47 One goal I have to improve my professionalism is to arrive at least 5 minutes early to lab every session. This goal is easily measurable, but I will know that I am successful if my peers and I don't feel rushed during the lab session, and peer teachers have an extra few minutes for their presentations. ID64

		Over the next month, I will ensure that I am at least 10 minutes early to every lab by leaving my apartment 30 minutes before lab starts. ID28 showing up on time at all times. This can be achived by arriving early on Campus for lab days and by asking my peers to hold me responsible if I am late. ID46
Organizational Skills	I have experience acting professionally and managing all the parts of a project or task…Sometimes I get bogged down in small details or forget small things that need to get done. ID33 I tend to overbook myself and do not know when to say "no" to events or student organizations. ID18 Weakness: Less efficient organization ID37 Weaknesses: o I find myself feeling overwhelmed because I am not as organized as I would like ID14 I think I could improve in my professional skills by staying on task. There are times I find myself getting distracted easily and I am quick to socialize when our team should be continuing to work through the material. ID76	I will work on my time management and keep my planner updated each week. I will at least look at my planner once a day. ID18 I want to not forget the small details. To do this, I will manage my calendar and email box more closely. When I get an email for task, I will write it down on a master list and then take things from that master list and put them on a calendar if needed. ID33 My goal would be to get a calendar that just tracks assignments and due dates, success would be no small assignment gets forgotten. ID75 I will take one day a week to organize my calendar and set boundaries by blocking out time for my personal/academic goals ID14

The third theme discussed in CDP part one was Professionalism skills in the context of the Gross anatomy lab. These categories included things like respect for the cadaveric donors and gross anatomy lab, preparing prior to lab to contribute fully to the dissection and be a better teammate by doing so, and acknowledgment of language use during dissections. Related goals included things like understanding that the gross anatomy lab is a professional environment and preparing appropriately for lab. Table 6.12

illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.12

Theme: Gross Anatomy Lab Professionalism Skills		
Category:		
	Strength or Weakness	Related Goals
Respect for Cadaveric Donors	Areas of Strength: Treating all donors with respect and dignity ID55 Strength- I act very professionally and respectfully to my donors as well as the other donors ID35 I treat all anatomical donors with respect and dignity. ID58 I am strong in showing up on time to lab, and treating the donors and my peers with respect. ID61 Sometimes I am careless in lab or am too nonchalant. ID3 Strength: respect -- respect for the donors ID60 I am also very conscious about how I'm speaking of and acting around the donors. ID27 Weakness: I will sometimes use "colorful" language when there is a part of dissection that is jarring. For instance, when dissecting the hand, there was what looked like blood that came out as I was skinning and that was particularly challenging for me. ID31	My goal is to tighten up and make sure to understand that this is a professional environment. I will achieve this by changing my language to fit that of a professional environment. ID3 If I overhear another disrespectful comment about an anatomical donor from a peer, I will address my concerns with my peer directly and respectfully. If this is not successful, I will ask for help from faculty. ID58 My goal is to not only carry myself professionally in the lab and outside of the lab, but to also hold my teammates accountable to these standards as well, specifically in terms of the appropriateness of comments being made during the dissection. This can only be achieved by me speaking up and educating my peers as to why certain comments may be deemed inappropriate and disrespectful towards the donors. ID61
Preparation for Lab	I am also always prepared in having the required materials (gloves, attire, etc) and am ready to pull up the lab guide on the iPad and find the corresponding page in Netter's atlas. ID76	My professionalism goal is to commit to excellence in the anatomy lab by reviewing the lab guides thoroughly enough before dissection days that I feel truly ready to dissect and identify

	coming prepared for lab so I can contribute a lot to the dissection and not be dead weight ID13 One weakness of mine when it comes to professionalism is always being completely prepared. There have been some labs where I did not have enough time to really learn the lab ahead of time and would need to consult the manual a lot during lab. ID53 Weakness: sometimes not being fully prepared or caught up on the lecture and it can take more time/slower to get started. ID44 Weaknesses: Always reviewing the pre-lab in its entirety upon arrival ID70 Always act professionally by bringing the correct size gloves to lab during each lab session. Purchase the correct size gloves needed during lab and leave them in my locker ID74	structures when I go into lab. I will review the guides and take notes on them, making connections to lecture content. ID71 Start the pre-lab 2 days before lab to allow ample time to complete it before lab day ID70 I will act professionally by more thoroughly going over lab guide prior to lab and drafting up a plan for efficient dissection with group members. ID37 I will work hard to be fully prepared, engaged, and respectful during our lab time. This includes proper preparation of the material ID22 I would like to be more prepared for dissection before I enter the lab. I want to be more prepared for each dissection by entering the lab not only familiar with the target structures and osteology but confident with the material by studying extensively beforehand. I will know I have succeeded if I do not have to rely heavily on the anatomy atlas for landmarks and identification while dissecting. ID52 I would like to have a clearer understanding of the structures we are dissecting before lab so that I can be a better contributor to the discussion around the dissection. I will try to memorize at least the names of most of the structures by lab time. I would like to be a better asset to my team. ID60 My SMART goal for professionalism is to always be prepared for lab by reviewing the lab manual and lecture material for each lab at least two days before the lab so that I have time to go back

		and review it before lab if I need to. I am hoping to improve my preparedness for lab by achieving this goal. I will attempt to achieve it by making dedicated time in my schedule for reviewing lab content so that I can come prepared and familiar with the content beforehand. ID53

Progress

In CDP part two, students were asked to reflect on their initial progress in their professionalism competency goals set earlier in the semester in CDP part one and to revise those goals or set new goals for the remainder of the CADE course. The first theme was students' progression toward their goals. Here, many students mentioned they intentionally worked on the professionalism competency, and several believed they mastered their original goal or need to continue working on their original goal due to not making much progress by mid-semester. Some students noted that they had not worked as much on progressing through the professionalism competency. Table 6.13 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.13

Theme: Progression toward Goals	
Categories:	
Have Intentionally worked on Professionalism Competency	I have intentionally worked on this and have made myself always thoroughly go through the lab guide before I go to lab, however I have not always done this at least two days before. Despite this, I have felt much more confident and prepared going into lab after working on this goal. ID53 I have worked on improving my professionalism and keeping track of the small details. ID33

	I have been working on improving my professionalism by only speaking well of my team mates. I have noticed that I slip up often in this competency, especially in moments of frustration. ID64 Yes, I have worked on improving my professionalism competency by striving to reach my goals and ensuring that I am staying on-topic and focused while in lab and during application exercises. ID20 I have intentionally worked on my professionalism competency as I have still never been late to lab and actively try to leave my home at least an hour before lab begins ID3 I have been very intentional about getting to lab 15 minutes early and making sure I am ready to go for the lab. ID27
Subcategory: Still working toward goals	While I have been making an effort to improve this competency, I still have progress to make. My goal was to arrive 15-20 minutes early to everything, but I still struggle with this. Recently, I have been 5 minutes early or right on time. I am still working on achieving this goal. ID47 I would say my goal of staying on task and limiting my socializing is one that I am still working on. ID76 my last goal was around not letting small assignments slip through the cracks and I have only submitted one assignment late so some room for improvement but not bad. ID75 As much as I developed and worked towards this goal I think towards the end of the block, inevitably, there was a lot of accumulated content and this made me not as prepared for lab on the back half of the block. This is a goal that I think I can continue to work on and become even more proficient at ID44 I have worked to leave my house earlier to make it on time to lab, but I have not been as consistent with goal as my others. ID19
Subcategory: Improved upon or met goals	My original goal for professionalism was to ensure I arrived at each lab on time, prepared, and ready to work! I have done so throughout the semester ID16 My original goal was to always participate in dissections with a very positive and optimistic attitude. I think that this is the goal that I have best mastered. ID13 My initial goal was to show up to lab on time and prepared. I achieved this goal by completing the preparation for lab that was assigned and making sure I am in the lab well before we begin to set up and begin on time. ID69 I met my goals for professionalism, which did not surprise me. ID50

	I believe I have mastered this goal due to not being overwhelmed this semester. I feel very organized from previous years ID18 I believe I have succeeded in my goal of not using expletive words in lab when I see something unexpected. ID31
Did not make much progress on goal	This past month has been a struggle and I did not always come to lab fully prepared and familiar with the lab guides. ID22 Honestly I initially made an effort for this goal, but as time went on I started to forget about it. I also think this may have been due to being tired and just focusing on doing the bare minimum which was responding back to my teammates questions. In conclusion, I did not make much progress with this goal. ID9 I have done poorly in achieving my stated goals in professionalism. ID14

Feelings toward feedback was a second theme present in CDP part two. Students were mainly unsurprised by the feedback they received and claimed that the feedback they received was mainly positive and they were happy to receive such feedback. Very few students mentioned if they were disappointed or surprised with the feedback received. Table 6.14 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.14

Theme: Feelings toward Feedback	
Categories:	
Positive Subcategory: Unsurprised	Thankfully my feedback did not reflect that my peers think I need much work on my professionalism, but because I set it as a goal I need to continue to work on it. ID19 I was not surprised by the feedback I received on my professionalism, because I'm very conscious of my behavior in the lab setting, as I want to honor and respect our donors, my classmates, and my professors the best that I can ID64 I was not surprised by the feedback because I made a point to achieve my goal. ID69

	I was not really surprised about the feedback I received because I gave my peers similar scores when it came to professionalism. I feel as though we were all at around the same level of maintaining professionalism, especially when necessary. ID28 I think that I have exhibited professionalism throughout the semester and was not surprised to get positive feedback on this aspect. ID71 in terms of responsibility, respect, and punctuality, I think I do well with professionalism. This was also reflected in the good reviews from my peers. ID70 I was happy to see positive feedback for this competency ID20 I got a 5 and no comments from my peers, which is a really good sign. I do try to uphold professionalism at all times and I am glad that is how I am being perceived. ID50 I believe I have maintained an optimal level of professionalism in lab and this was reflected in my peer feedback ID10 I was pleased that my peers were satisfied with my performance in regard to professionalism. ID55

Gross anatomy lab professionalism skills were mentioned again in CDP part two, with students reflecting upon their original goals and some creating revised/new goals toward honoring and respecting the cadaveric donor and improving time management in lab and preparation for lab. Table 6.15 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.15

Theme: Gross Anatomy Lab Professionalism Skills Progression	
Categories:	
Preparation for Lab	My original goal was to do better at preparing before lab. I failed to include a measurable component into this goal. Some labs I did better at this than others. I did start incorporating the relevant lectures into my pre-lab review and making my own powerpoint with images from the lab guide to review later. ID70 I think I have come into the lab with a stronger understanding of the relevant anatomical relationships before dissection, which has made me more comfortable and confident during lab. ID52 While I do not always review the lab manual at least two days before lab, I have been successful in working it into my study schedule so that I have plenty of

	time to read it and work through it before lab. If I do wait until the day before, I always make sure that I am doing it no later than the afternoon so that I am not rushed for time while going over it. While I do not always know all of the content before going into lab, I have been able to answer questions about our next steps during the dissection without having to look through the manual each time. ID53 This past month has been a struggle and I did not always come to lab fully prepared and familiar with the lab guides ID22
Preparation Goals:	One way that I can be more professional is to come as prepared as possible to lab before the dissection occurs. I have a tendency to skim through the lab guides before bed the night before a dissection. I will make sure that I read the lab guides thoroughly the day before each dissection during the last block ID71 I will work this upcoming block to be better prepared to better help my group as we work through this content together. ID22 While I have kept up with the lab manual aspect of my goal, I would like to focus more on the lecture content as well since I found myself being more prepared for the lab and dissection aspect than knowing the general lecture content. I plan to continue reviewing the manual before lab as well as make sure I look through the lecture content at least once on my own the same day that we had the lecture so that I can understand that aspect of lab better. ID53 I will arrive better prepared to lab. -Plan: I will do the 1 day prior to my scheduled lab & I will re-watch the lecture on 2x speed of the relevant anatomy for my scheduled lab. -Measures: I will show up to lab with a pre-annotated checklist (which indicates I have review the anatomy more thoughtfully prior to entering lab) ID70 I would like to continue working on my preparedness for dissection by studying the class content before lab. While I have begun to review class content before lab, I sometimes have only reviewed the content once or twice, so I am not entirely confident before dissection. In the future, I would like to have completed each of the learning objectives associated with each lecture before lab to ensure that I know what I am looking for during dissection. ID52
Honor/Respect for Cadaveric Donors	I make certain the tissues or organs of each donor are in there appropriate location. I put max effort into cleaning my area at the end of lab. ID74 I think the one thing I have lacked in is the proper preservation of our body donor. Like many other bodies, our body donor has dried considerably toward the end of the semester. As keepers of our donor's temporary resting place and remains, I want to do a better job caring for them. ID23 I make a great effort to be professional in the lab. I try to honor our donors and keep the gravity of what they have given us in mind. ID60 I have worked to make sure that I am remembering that our donors were people who graciously donated to the program, because I think this is one part of the professionalism competency that people can start to forget as the semester moves along and we become more accustomed to being in the lab. ID71

Goals for Honoring the Donors	I want to be a better steward to our donors. As the faculty pointed out, the donors were looking pretty dry and shredded by the end of block 4. I have made a good effort to take good care of my personal donor, but I should be certain to wet and cheesecloth every donor I walk away from -- especially when I'm in the lab after hours. ID60 A new goal that I would like to set is holding other peers accountable for respecting the donors. I will achieve this goal by politely and privately addressing a classmate who makes an inappropriate comment and explaining to them why it is disrespectful. ID13 Treating the space we are in as a professional learning environment. This means cleaning correctly, taking care of cadaver specimens, following the rules of the lab, and maintaining the respect a lab containing human remains should aim to contain. ID66 I will ensure proper maintenance of my willed body donor by performing proper wetting techniques every time that I am in lab. ID23 I can improve my skills in the professionalism competency by keeping in mind the environment and context in that the body was graciously donated to help us as students. Sometimes it's easy to forget that and jokes can be made. I will be more conscientious in the lab environment.ID3 A flaw of mine is joking and laughing as a defense mechanism, and sometimes I can joke too much during more serious events. For the majority of the time, I maintain my professionalism while joking but every once in a while, I may laugh or make a joke that can be unprofessional, so I will work on this for the remainder of the semester by understanding the environment around me and recognizing when to refrain from joking. ID20

The Responsibility skills theme, namely time management and punctuality, was discussed again in CDP part two, with students reflecting on how their time management skills have progressed since the beginning of the semester and whether they still need to work on better time management. Some students recognized at mid semester that they need to work on better time management, so they created goals to accomplish this task. Table 6.16 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.16

Theme: Responsibility Skills Progression	
Categories:	
Successful time management	I believe I have mastered this goal due to not being overwhelmed this semester. I feel very organized from previous years. I have been actively checking my planner twice each week. I usually check my planner before I leave for school and before I go to bed at night. At the beginning of Block 2, I wrote all lecture days, mandatory events, and outside activities in my planner. ID18 I have been very intentional about getting to lab 15 minutes early and making sure I am ready to go for the lab. ID27 I have intentionally worked on my professionalism competency as I have still never been late to lab and actively try to leave my home at least an hour before lab begins ID3
New time management goals	Since the last goal has already been met in my perspective, moving forward I think an appropriate goal in terms of professionalism would be not only showing up on time, but showing up ready to go on time. This means having our iPad out with the lab guide and checklist pulled up, our body out and ready to go before lab time starts at 9am. So far, I have tried to do so and have achieved this on multiple occasions, but as of late, some of these last labs I was walking in right on time, which was out of character for me. Being "right on time," in my eyes, is being late. I will continue to work on improving my time management skills the morning of the lab in order for our dissections to go as smoothly as possible. ID61 A new aspect I could work on would be punctuality. I am never late to lab or lecture but I do tend to arrive to most things right before they start. Being I live a 7 min walk from campus I can easily work on getting to Lab or lectures in excess of 5 min before start time. This can allow me to help setup lab as normally my team members that arrive before me setup. To accomplish this I can wake up 10-15 minutes earlier to allow me the time to get to lab early. ID81 While I am slightly earlier for labs than I was before CDP Part One, I would like to push myself to be even earlier. I am now about 5 or so minutes early. I would like to push myself to be at least 15 minutes early to lab to ensure that my group has adequate time to review and prepare prior to dissection. ID55 In order to improve my professionalism, I will work towards arriving to lab early rather than on time so that I am prepared for the day and not delaying our lab group. Over the next block, I will arrive to school 15 minutes before lab begins so that I am changed and ready for lab 5 minutes before it starts. I will set my alarm 30 minutes earlier on mornings that we have lab in order to give myself more of a buffer to get to school on time. I will try to be the person in my lab group who gets the iPad for the day as a way of measuring this goal because usually the first or second person to arrive grabs the iPad for the table. ID28

	Another goal for professionalism is work on relying to messages in a timely manner and work on arriving earlier to lab. This can be gauged by the time I enter lab/ respond to messages. In order to do this, I should leave earlier and look at my messages a couple times a day. ID50 One revision by which I can improve this competency is by going to bed earlier so I struggle less in the mornings. By doing this, I should be able to wake up earlier to arrive earlier. ID47 I am not a morning person, sometimes struggle to get out of bed, forget to prep my bag for the day, but these are all just excuses that could be avoided if I work harder to meet my goal. Smaller steps like prepping my lunch the day before lab days will help me with my time management the morning of lab. ID19 I have only let one assignment become completely forgotten but some have been close so I would like to get better at keeping a daily calendar. ID75 A goal of mine is to improve my time management skills in the lab. I notice I get bogged down trying to figure things out on my own. However, it would be more efficient to use the resources around me. ID69

While the interpersonal/social skills theme did continue into CDP part two, students shifted from an introspective look at their individual professionalism competency skills to a reflective outlook on the overall professionalism of their teams throughout the semester thus far. They set goals related to acting professionally toward their teammates or ensuring that their team worked toward competency in professionalism. Table 6.17 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.17

Theme: Professionalism of Team	
Interpersonal/ Social Skills of the Team	As the semester has progressed, I feel that this competency has not needed to be addressed, as I believe and have experienced nothing short of professionalism by my peers…so far I believe we have all carried ourselves with respect and dignity, especially with regard for our donor and the other donors in the lab. ID61

	I believe that my lab group and I have treated our body donor with great respect. I believe we also have treated each other with respect and honesty. ID23 We've done a fantastic job of making sure that each member receives appropriate and equal praise and feedback for dissections well done. ID55 I do believe my teammates and I work very well together because we get along so well ID76 I feel as though we were all at around the same level of maintaining professionalism, especially when necessary. ID28 My original goal was to always participate in dissections with a very positive and optimistic attitude. I think that this is the goal that I have best mastered. Not only just on my own but also as an entire group, since we are now all coming to lab with a very positive and optimistic attitude. ID13 My roommate and I will hold each other accountable for this goal by making sure to ask each other about completing the lab guides. ID71 I am blessed to have wonderful teammates that have established a very supportive and respectful dynamic with one anther, that conflict has yet to really plague our group atmosphere. However, that doesn't mean my teammates have internalized any misgivings or that conflict won't emerge at some point. We should be open and honest, and have a discussion on how we would go about handling this issue if it does arrive ID16 One goal I have for the remainder of the semester is for my teammates and I to become better at problem-solving and getting things done on our own. While I feel that we have improved upon this as the semester has gone on, often times we wait around for help to make sure we don't mess things up during the dissection. I think that instead of worrying about messing up, we should try our hardest to work through the problem on our own using what we have learned thus far and then, only if we are absolutely unable to come to a decision, ask for help. ID27
Theme: Professionalism toward Team	
Interpersonal/ Social skills	I will also achieve this by encouraging my classmates and team to uphold this professionalism as well as addressing people when professionalism is not being respected. I will measure this by reviewing formative feedback and discussing it with my teammates as well. ID66 Give teammates my full attention when they are talking to me…I will ask my teammates to hold me accountable for this goal. If they see that I haven't stopped to give my full attention, then they can bring it to my attention that I am not actively engaged in conversation. I will identify my success by decreasing the amount of time my team members have to call out my behavior. ID9

	revise my goal to only speak well of my teammates and to confront them openly when I have a complaint, instead of always confronting them in person I will at least send them a text message. In person confrontation an be difficult to achieve, especially right in the moment of frustration. I will think before I speak to my teammates and always confront them privately. I will implement if/when the next conflict arises. ID64 A new goal I have is to ask for feedback from my peers at the end of each week to see how I can best support them the following week, (for instance if they will be out of town, have a sick loved one etc.) and allow them the opportunity to suggest any areas of growth I could improve upon. I think it is important to make sure that I am being perceived by my peers in a professional manner so that as a physician I can uphold this level of professionalism as well.ID31 My goal is to go beyond the basic professional attitude and periodically let my teammates know that I appreciate their contributions and assistance with the various tasks we will have for the remainder of the semester. ID4

Development

In CDP part three, students were asked to give a summative reflection on their overall development within the Professionalism competency throughout the CADE course (from August-December) as well as to discuss how they will continuously maintain/improve skills in this competency as it relates to the medical field moving forward. Here, students mainly discussed their progress toward their goals throughout the semester with many noting their skills improved since August and being proud of the improvements. Some specifically noted how they became better with organizational skills such as time management, keeping a calendar, better preparing for lab, and learned interpersonal professionalism skills such as learning to speak up when others are unprofessional, filtering self before speaking, and treating teammates with respect.

The main theme of CDP part three was progress in professionalism competency over the CADE course. Many of these reflections shared a general belief of improved professionalism skills since the beginning of the course. However, some students

reflected on their improved organizational skills, interpersonal/social skills, respect for the human donors, and how feedback reflected improvement. Several students mentioned how they believed they maintained a consistent level of professionalism from the beginning of the course to the end of the course. Table 6.18 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.18

Theme: Progress in Professionalism Competency	
Category:	
Belief of Improved Professionalism Skills	I think my professionalism has improved since august. It has really set in, the feeling of professionalism and responsibility that comes with being a doctor in training. ID19 Since August I have become more professional in every aspect of medical school ID69 In regard to professionalism, I think that I have grown in this aspect and was able to further expand upon my skills that I obtained coming in to medical school. ID34 I have definitely improved in my professionalism competency since August. Before school, my professional experience and training was limited. However, now I have gained vital professional skills for life and for my time in the medical field. ID35 I have improved on my professionalism as a student ID37
Subcategory: Time management/ organizational skills	I finally got good at being 5 minutes early rather than being right on time. ID55 I originally wrote about keeping up with the small details and ensuring that I keep track of all responsibilities. I accomplished this goal thanks to a new calendar and notebook for writing down details I would be likely to forget. This new system has worked well and allowed me to keep up with many goals I may have forgotten in the past. ID33 I began to manage my time more effectively, say "no" to anything that could possible distract me from my studies, and allowed myself to have some more personal/individual time. ID18 I believe that I showed professionalism throughout the semester and was always intentional about showing up on time. ID71

	I was able to get in a groove of studying and understanding material in an efficient and time-effective manner, while also getting comfortable interacting in small groups more often, lab included. Namely, for lab, I was showing up ready to go and prepared for dissections with knowledge of pertinent lecture materials ID61
Subcategory: Interpersonal/Social Skills	I have improved in my professionalism since the beginning of the semester. I have made conscious efforts to stop what I am doing and give someone my full attention when they are talking to me ID9 I have improved my professionalism skills since the beginning of this semester by learning much more about professionalism in group settings especially when it comes to working with peers. ID53 Coming from a pathology background, maintaining a high degree of professionalism was not only important but required. As time went on, I think it only improved as my group members and I became used to working with each other ID4 I have been on time for our labs and teaching and treated my team members with respect. ID46
Subcategory: Feedback Reflects Improvement	I was happy with the formative feedback I received the second time around and confirmed that my professionalism competency has improved throughout the semester. ID27 I have improved my professionalism skills. I know i improved mine because my peer feedback recognized that fact. ID38 I was happy to see my formative feedback reflect my progress in this competency ID53 I have improved my professionalism skills by learning to contain my emotions and not let them color my professional relationships. I know I've improved my skills because of my teammate formative feedback reflections well as my own personal reflection. ID64 I feel as if the formative feedback I have received reflects this growth. ID76
Subcategory: Respect for Human Donors	I took our time in the lab seriously, and the magnitude of our donors' gift of themselves wasn't lost on me. ID60 I made a conscious effort to act professionally, especially in the lab setting to properly respect our donors. ID64 Going into medical school, I was most tepid about the willed body lab. I did not know how to react to seeing a body and working with that body. After our semester of lab, I am most proud of how I handled my donor with respect. I think working with the donor taught me, in addition to anatomy, how to properly care for my future patients. ID23 I started off the year without much of a filter in lab. When I saw something shocking or alarming I would say the first words that came to mind, which

	weren't always the most professional. I have grown so much in this skill throughout the year. I think part of my growth has come from being exposed to more things in lab and during preceptorships. I imagine that my tolerance for unexpected and surprising scenarios will only continue to grow the longer I am in healthcare. I know I have developed this skill because I now pause when I experience an unexpected situation and collect myself before speaking. ID31 I believe I have improved my skills in professionalism since August. With each lab, I realized how important it was to come fully prepared for dissection; it is much easier to dissect when you already have a strong idea of the spatial relationships involved. ID52
Maintained Professionalism Throughout	Professionalism is something I strive towards daily, and in this environment, it is crucial for the integrity of the class. Throughout the semester, I felt that I maintained an adequate of professionalism and I believe my group can attest to that ID4 I think I have done a good job throughout the semester demonstrating and maintaining a level of professionalism ID16 I maintained that same level of professionalism throughout the semester. ID70 I believe my professionalism at the beginning of the semester was adequate as I show up on time, treat my colleagues with respect, and am honest when making a mistake. I did not have any issues with my professionalism competency at the beginning of the semester, and throughout the semester I maintained this competency. ID20 I believe I have always maintained a high level of professionalism since the beginning of my medical school journey. ID10 I have been reliable throughout the whole semester by getting the work done on time and responding to requests in a timely manner. ID46 I believe my level of professionalism has stayed consistent ID3

For many students, they were unsurprised by their positive feedback that in some cases was consistent from the beginning of the semester to the end. Table 6.19 illustrates the created category within this theme along with excerpts from the dataset to illustrate why this category was created.

Table 6.19

Feelings toward Feedback	
Category:	
Positive Subcategory: Not surprised	Receiving a 5/5 professionalism rating within a professional school means so much to me. I pride in myself in always having a professional attitude, demeanor, and respect when it comes to anything I do in my career. I was hoping I can adapt this to the medical school setting and I believe through this semester I have achieved that goal. ID66 I'm proud of the professionalism scores that I received ID60 I was not surprised by the feedback I received but I can continue on my professionalism overall because it is still new and an important part of our education/preparation. ID19 I was not surprised by the feedback from my peers the second time and I don't think their feedback for me changed for this metric. ID70 I was not surprised by my formative feedback because I try to be professional in all of my academic encounters and my feedback was pretty similar to what it was in the beginning of the semester. ID28 I think just due to how I was raised and the values of my parents, punctuality, respect, and honesty have come quite naturally to me, so I was not surprised to see that I had a very high formative feedback score for professionalism. ID13

The second major theme of CDP part three was maintenance of Professionalism in the medical field. Here, students discussed how they would maintain conscious competence within professionalism, through asking for and receiving feedback and using self-reflection, as well as through practicing professionalism skills to ensure competence. Many students also mentioned taking what they had learned from this semester forward as they continue their medical education, and the importance of professional relationships with future peers and future patients. The general recognition of the importance of professionalism in the medical field was also discussed by students. Table 6.20 illustrates the created categories within this theme along with excerpts from the dataset to illustrate why these categories were created.

Table 6.20

Theme: Maintenance of Professionalism in Medical Field	
Category:	
Ensure Conscious competence Subcategory: Feedback and Reflection	I found that the value of being presentable and prompt in your work is important, and I want to set goals to ensure these are always core values for me. These goals include bringing equal care to my fellow staff and patient in the medical field through keeping regular "journal entries" on how I am getting along with work and the people involved, as well as bringing a calm demeanor and leadership into my work. ID54 I will ask for feedback to ensure that my professionalism skills are exceptional and ask for any suggestions for improvement. ID47 I also anticipate that feedback from peers and faculty will help me fine tune my professionalism as well. I will ensure that I continue to develop in this competency by checking in with mentors along the way to see what areas of growth I can improve upon with professionalism and through self reflection on my interactions with people across all aspects of healthcare to see if the way I am presenting myself is the way I want to be perceived. ID31 Before going into a situation I will reflect and think to myself if what I am about to do or say is professional. ID44 reflect on how to improve my professionalism skills ID10 As I move forward, I will have this perspective in mind. As a medical professional, I will ensure I am consciously competent in this are by asking myself "Are you meeting the expectations you have for your own physician?" This will do two things: allow me a moment to reflect on my actions and make improvements ID9 I will work to be consciously competent in this skill while in the medical field by consistently reviewing the aspects of professionalism to make sure I am following them. ID53
Subcategory: Practice	I will strive to be professional in whatever setting I find myself to ensure that I am consciously competent in this skill as a medical professional. ID37 I plan to maintain this skill by always being professional in my interactions at school in group settings or in other settings like shadowing or volunteering. I will work to be consciously competent in this skill while in the medical field by consistently reviewing the aspects of professionalism to make sure I am following them ID53

	As I become a medical professional, I will ensure that I am consciously competent in professionalism by paying attention to what others are saying about me and to how they react to me and using these reactions to determine if I am being perceived professionally and to inform how I will need to adjust my behavior if necessary. ID13 With many more opportunities to participate in small group settings, I'll have experienced a wide range of group dynamics by the time I am a physician. Being cognizant of my opportunities to practice these skills now will better equip me to problem-solve and effectively interact with my colleagues as a physician. ID61 Practicing my professionalism skills with my classmates and faculty will only help me improve and improve my professional relationships in the future. I will continue to work/converse with my classmates in a professional manner to practice my skills. ID19 As a professional, I will have to continuously maintain and improve my professional skills. My plan is to never stop learning.ID74 I will continue to maintain and imrpove my skills by being conscientious of others, having integreity, being honesty, being respectful, being appropriate, and being confident. ID3 I will be patient with others and use empathy while interacting with others. I will ensure I am consciously competent by remembering that I wear a white coat and must uphold all the standards which come with it. ID23
Take what I have learned forward	as I move forward I will have to actively ensure I modify the calendar or program I am using for managing deadlines to ensure I am always keeping track in the best way possible ID75 Moving forward, I will continue to use what I have learned over the years to make a positive professional opinion. I envision a clinical setting where I treat everyone I encounter in a way that I would like to be treated with respect and kindness ID14 I will take the professionalism skills I have learned and continue to work on them with everyone I encounter. ID19 Moving forward, I will maintain professionalism by being punctual, treating all colleagues with respect, being honest when mistakes are made, and taking actions when others are not acting professionally. ID20 Moving forward, I plan to use what I've learned about professionalism to serve as a constant reminder of the standards that I need to hold myself and my colleagues to. ID13

	I want to ensure that I carry the leadership skills, the communication skills, and professional skills I have learned this semester into my medical professional career. ID27 I can continue to become a better professional as I progress through school and the rest of my career by continuing to be mindful and respectful of my patients, peers, students, teachers, coworkers, etc. ID35
Professional relationships with peers and future patients	I will continue to develop strong professional relationships with my peers and my superiors as I value the camaraderie and mentorship respectively that comes with that. ID47 I know how easy it is for healthcare workers to feel burnt out, especially if they don't feel respected in the work place. I plan to vocalize to my coworkers often that I appreciate their work. I plan to minimize any workplace gossip, as it is easy to slip into but harms working relationships. I know that if my energy is focused on the patient, I will be able to properly respect everyone around me. ID64 I will always respect those I am working with wether it be the donor in lab, a patient, other medical students, or physicians. ID76 My plan is to continue to think before I act, handle things with grace, and so empathy toward others. This is the only way we will transform our broken healthcare system and build a more positive rapport with patients and other colleagues. ID50 I would maintain my professionalism by being reliable, responsible, and respectful toward my teammates and patients that I will encounter. ID46 In a field in which people at their most vulnerable state entrust professionals to take care of them, it is crucial that we maintain that trust through open dialogue, respect, and honesty. ID4
Importance of Professionalism in Medical Field	Professionalism is such a crucial aspect to working in any career field, but especially in the medical field, whether it be with our colleagues or our patients and their families. ID34 I began this year with the goal of making friends and being successful in courses. This is my first time in a professional school so I didn't realize how important it was to make professional friendships. ID31 This semester has been the beginning of my professional development as a future physician, and this process will never stop. I can always learn and grow in the area of professionalism. ID22

Overall, three main themes emerged longitudinally across the students' Professionalism

CDPs: Interpersonal Relations/Social skills, Responsibility Skills, and Gross Anatomy

lab specific skills. These themes and their prominent subthemes are depicted in Figure 6.3.

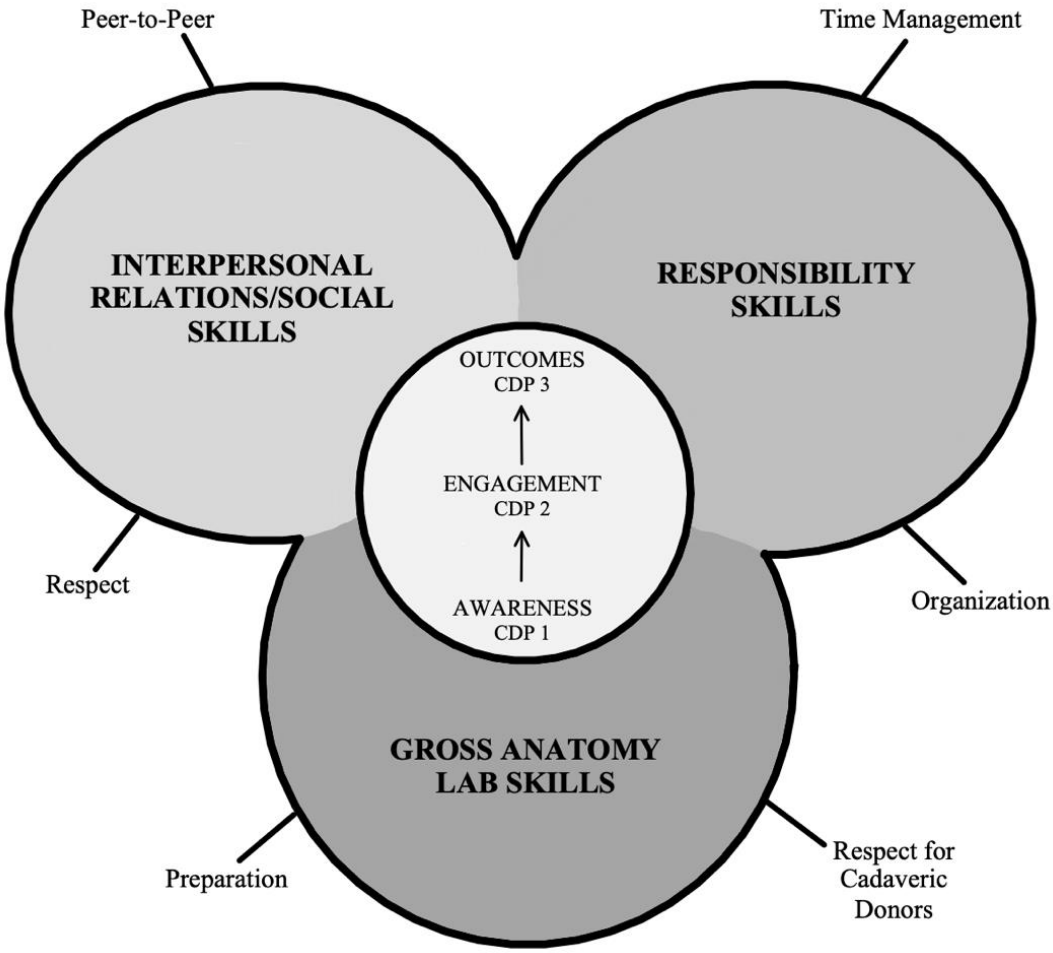

Figure 6.3. Professionalism Competency Development Themes and Subthemes

6.4. Discussion

This study used quantitative self- and peer-assessments along with qualitative self-authored longitudinal portfolio reflections to investigate professionalism competency development of first-year medical students in the gross anatomy lab context over time. The quantitative results indicated that first-year medical students at ULSOM self-assessed professionalism at a very high level (>4.8) (Said, 2023) and they did not exhibit self-assessed growth from the beginning of the semester to the end of the semester (Table

6.4 and 6.5). The quantitative results also demonstrated that students assessed their peers at a very high baseline level (>4.85) (Said, 2023), and that students perceived that their peers had improved professionalism skills from the beginning of the semester to the end of the semester (Table 6.7 and 6.8).

The qualitative results revealed three main themes that coursed throughout all three entries of the CDP over time: Interpersonal Relations/Social Skills, Responsibility skills, and Gross Anatomy lab specific professionalism skills. These themes involved many skills within the professionalism competency that students had personal strengths and weaknesses within and set goals for improving throughout the semester. They reflected on progression through those goals and stated how they believed they either maintained, were still working on, or improved upon their skills within these themes since the beginning of the semester.

For students who discussed aspects of Interpersonal Relations/Social skills, at the beginning of the semester there was a focus on their strengths and weaknesses in respecting others and peer-to-peer professionalism. Students noted strengths in respecting others' time and treating others with respect, while some noted weaknesses in respecting others by interjecting when others are speaking or not giving others proper attention while they are speaking (Table 6.10). An aspect of respect is honesty and accountability, and many students discussed weaknesses in acknowledging when they make mistakes and speaking up if a mistake is made. Students set goals around admitting to mistakes if they occur, keeping eye contact with others to give them full attention when they are speaking, and being honest with and expressing feelings to their teammates when needed (Table 6.10). Students also discussed weaknesses with peer-to-peer professionalism, like

lacking professionalism around peers because “working with peers and hanging out with friends is a fine line” and avoiding taking action if a peer is acting unprofessionally. With students specifically noting being weaker in addressing other’ inappropriate comments in the gross anatomy lab. These students set goals to uphold their peers to a higher standard of professionalism and to take action on unprofessional peer behavior if it occurs (Table 6.10).

At mid-semester, there was a shift within this theme from a self-directed focus to a team-directed focus on interpersonal relations/social skills. In the first CDP, students discussed being honest with and accountable to *themselves* in advancing professionalism, as well as working toward *personally* addressing unprofessionalism of others. By contrast, in CDP entry two, students reflected more on their own individual professionalism goals of their team and toward their team. The tone of students’ reflections clearly shifted from a “me” to a “we” perspective, with students noting how they believed their teams treat each other with respect, honesty, and accountability, and how their teammates work well together and maintain professional, positive attitudes (Table 6.17). Students created goals involving how to treat their teammates professionally for the remainder of the semester. These included goals like giving teammates their full attention, confronting teammates privately if there is a conflict, asking teammates for feedback on how to improve and having teammates hold them accountable for their goals (Table 6.17). By the end of the semester, some students discussed beliefs of improving aspects of interpersonal relations/social skills by making conscious efforts to give others their full attention when speaking, learning about

professionalism in group settings with peers, getting used to working with the same team, and treating team members with respect (Table 6.18).

For students who discussed aspects of the Responsibility skills, at the beginning of the semester there was a focus on time management and organizational skills, including punctuality to lab sessions. Several students indicated strengths in punctuality, showing up early and being ready to go, while many students indicated weaknesses in being punctual and arriving right on time to scheduled events. These students set goals for how to improve their difficulties with punctuality, like leaving their houses earlier, showing up several minutes early to scheduled lab sessions, and asking peers to hold them accountable if they are ever late (Table 6.11). Students also mentioned some difficulties with organizational skills like staying on task, forgetting details, and being overwhelmed due to not being very organized. These students had goals involving keeping a calendar or planner and looking at it daily and keeping track of tasks in lists and within calendars (Table 6.11).

By mid-semester, several of these students had assumed a more self-perceived control of the responsibility domain, citing achieving mastery or acting intentionally toward goals in this area, specifically in regard to successful time management resulting in punctuality to lab and planner/calendar organization resulting in being less overwhelmed and keeping track of all tasks (Table 6.16). Another subset of students, however, at mid-semester realized they were struggling with the responsibility domain. These students created new goals surrounding time management for the remainder of the semester. These goals consisted of actions like going to bed earlier, waking up earlier, prepping lunch the night before rather than morning of, showing up several minutes

early, and being ready to go by the start of the lab session (Table 6.16). Students recognized needing to show up earlier rather than right on time so that their teammates did not need to do all of the set-up work prior to lab starting, like grabbing an iPad with the dissection guide for the day.

By the end of the semester, students who reflected on their Responsibility skills claimed they believed they improved their skills over the course of the semester by getting better at arriving earlier rather than right on time, saying "no" to potential distractions from studies, and keeping track of small details and responsibilities in a more organized way (Table 6.18). Some students noted how they still had room for improvement within this domain, whether that was to get better at showing up earlier to events or recognizing that juggling multiple deadlines and responsibilities will continue and thus developing a mechanism for managing time most effectively will be crucial moving forward.

For students who discussed Gross Anatomy lab-specific professionalism skills, at the beginning of the semester the students focused on personal respect for the cadaveric donors and preparation for lab sessions. Many students recognized how they consistently treat the donors with respect and act professionally around and toward the donors, while some students noted how they can sometimes be careless in the lab setting or make inappropriate remarks or use inappropriate language when dissecting the donors. These students acknowledged the need to understand that the lab is a professional environment and to use language that fits that environment (Table 6.12). While other students noted that if they hear their peers make disrespectful comments toward or around the donors that they will address their peers respectfully but hold them accountable to being

appropriate around the donors at all times (Table 6.12). Students also discussed preparation for lab sessions, with many noting that they are not always fully prepared for lab in that they did not fully review the pre-lab guides or lectures prior to their dissection days. Several students set goals surrounding being better prepared for lab by doing the pre-lab a few days ahead of time, reviewing lecture material for lab days in advance, and taking notes on the dissection guides so that their dissections progress more efficiently and they feel more confident with the material when they step foot into the lab (Table 6.12).

At mid-semester, some students reflected on how they believed they were doing a better job at preparing for lab, having a stronger understanding of the anatomic relationships prior to dissecting them which increased confidence and comfortability in the lab setting. Other students reflected on how they were still struggling to consistently prepare for lab ahead of time (Table 6.14). As students set or revised their goals for the remainder of the semester, they planned to read the dissection guides thoroughly the day before each dissection, become more comfortable with lecture content, and show up to lab with pre-annotated checklists to indicate they had prepared prior to lab (Table 6.14). Students noted that being more prepared will contribute to helping their dissection team work through the content together. Several students also reflected on how they had treated their cadaveric donors thus far in the semester, with the majority stating they were taking proper and appropriate care of their donor and cleaning their lab areas. It was also noted that thorough preservation of the donors was sometimes lacking, and "as keepers of our donor's temporary resting place and remains, I want to do a better job caring for them" (Table 6.14). Therefore, some students set goals for honoring their donors

throughout the remainder of the semester. These goals included being a better steward to the donors by ensuring proper maintenance using appropriate wetting techniques, holding others accountable for respecting the donors, and being more conscientious in the lab environment by avoiding making jokes.

By the end of the semester, students who reflected on their gross anatomy lab-specific professionalism skills noted how they took their time in lab seriously and acknowledged the magnitude of the donors' gift, being proud of handling their donor with respect even with being timid about working with the donor at the start of the semester and improving language use in the lab and other professional settings (Table 6.18). It was noted that "working with the donor taught me, in addition to anatomy, how to properly care for my future patients" (Table 6.18).

These results from the quantitative and qualitative methods were triangulated to determine if convergence occurred or if discrepancies were observed between data sets. Methodological triangulation was useful and necessary to address multiple aspects of the same phenomenon--professionalism competency development over time in the gross anatomy lab context. This triangulation aimed to address the following questions:

- Do first-year medical students exhibit statistical growth over time? If so, how? If not, why? (*Quantitative results + Qualitative results/discussion)*
- What skills do students already possess in this competency, what skills did they believe they gained or improved upon? (*Qualitative results/discussion)*
- How do students feel about their progression in the competency? (*Qualitative results/discussion)*

The quantitative assessments provided static snapshots of students' behavioral professionalism skills and the opportunity to determine if growth was self- and/or peer-perceived, while the open-ended qualitative portfolio entries furnished the opportunity for longitudinal exploration of student perspectives on their progression through behavioral attributes of professionalism in the gross anatomy lab context.

The quantitative aspect of this study demonstrated that first-year medical students at the ULSOM did not exhibit statistically significant growth from PAS-SA-1 to PAS-SA-2 (p = .108). There are several reasons why this finding may have occurred. Within the CDPs, when students reflected upon their strengths and weaknesses at the start of the semester, many students indicated that professionalism was already a strength coming into medical school (Table 6.10) and resulting in students ranking themselves very highly (Said, 2023) on the PAS early in the semester (M = 4.81). As they progressed through the semester, students noted how they felt like they had maintained a high level of professionalism ever since the beginning of the semester (Table 6.18). This likely contributed to students ranking themselves at a similarly high level on the PAS at the end of the semester as they did at the beginning of the semester (M = 4.85), resulting in no statistically significant growth or decline and rather a high maintenance level of Professionalism skills. While overall statistically significant growth was not found between PAS-SA-1 to PAS-SA-2, a subset of students discussed how they interpreted they had improved Responsibility skills such as time management and organization over the course of the semester (Table 6.18), and when directly comparing the Responsibility item statistics from the PAS-SAs, students did demonstrate increased skill in using time

efficiently (*M* =4.71 to *M*=4.83) and in being self-directed in undertaking tasks (*M*=4.71 to *M* = 4.81).

The quantitative aspect of this study also demonstrated that first-year medical students at ULSOM perceived their peers to have exhibited statistically significant growth on the PAS-PA ($p = .005$). When looking at the literature, this result is consistent with previous medical education Professionalism self- and peer-assessment studies that found that students tend to underrate themselves compared to ratings received from peers (Davis et al., 2006; Hoffman et al., 2017). Students self-assessed themselves lower than their peers assessed them at the beginning (Self *M* = 4.81/Peer *M* =4.89) and at the end of the semester (Self *M* = 4.85/Peer *M*=4.93). A possible reason for this discrepancy in our study is showcased in our qualitative results. In CDP part one, students mainly focused on intrinsic professionalism skills, weaknesses, and goals, and by CDP part two, some students had shifted to discussing the successful professional attributes of their team as a whole (Table 6.16). This un-prompted recognition and reflection on the professionalism of peers could indicate why we saw an increase in peer-ratings, and statistically significant growth from PAS-PA-1 to PAS-PA-2.

Overall, the qualitative results combined with the quantitative results gave us a more holistic picture of first-year medical student Professionalism competency development over time in the gross anatomy lab context. We have found that students in this context self-assess and peer-assess at a consistently high level (Said, 2023), and that students perceive their peers to have increased professionalism skills over the course of the semester. We have also found that students have an overall belief of either maintaining their already high skills within professionalism over the course of a semester,

or of improving certain aspects of the competency such as organizational and time management skills. Since peer-assessment has been found to be valid and reliable (Dannefer et al., 2005; Hoffman et al., 2017; Spandorfer et al., 2014), combining it with self-assessment and self-reflection provides a holistic form of multisource feedback (MSF) to provide students with an understanding of what is expected of them and what to expect of themselves professionally in the first year of medical school in the gross anatomy lab context.

This study also indicates what qualities first-year medical students consider the most relevant when asked open-ended portfolio questions regarding the professionalism competency in the gross anatomy lab context. Respect, maintaining and balancing professionalism with medical student peers, proper time management, organization, and punctuality, honoring and respecting cadaveric donors, and preparing appropriately for lab were the aspects of professionalism that students acknowledged most frequently.

Students identifying the importance of honoring and respecting cadaveric donors and understanding that is an aspect of professionalism development indicates that the Gross anatomy lab is a feasible venue to incorporate professionalism assessment for first-year medical students. Working with a cadaver for an entire semester inherently poses moral and professional challenges for these students, as the donors embody the students' "first patient" and they exhibit total dependence on the students just like a patient exhibits dependence on their doctor (Escobar-Poni & Poni, 2006). As students cannot have a discourse with their donors, they must make critical moral and professional decisions while working with a donor, including what language they use around and when referring to the donor. Recognizing and reflecting upon these moral and professional questions

early in their medical education (Table 6.12, 6.15, 6.18), encourages students to learn important professional values that will be directly applicable to their future practice as physicians—like maintaining patient confidentiality and dignity and behaving with respect and integrity (Palmer et al., 2020).

CHAPTER 7

SUMMARY, DISCUSSION, AND CONCLUSIONS

7.1. Summary

This mixed methods study has investigated Communication, Teamwork, and Professionalism competency development of first-year medical students using competency-based assessments in the gross anatomy lab context. The study employed a convergent parallel mixed methods approach where the quantitative and qualitative data were collected concurrently, analyzed separately, and then triangulated to give a holistic description of first-year medical students' competency development over the course of their first semester in medical school.

The quantitative phase used a pretest/posttest design with paired dependent *t*-tests to determine if students' exhibited growth, stagnancy, or decline within any of the three competencies over the semester. The analysis resulted in three main conclusions: 1) students exhibited statistically significant self-assessed and peer-assessed growth in the Communication competency, 2) students did not exhibit statistically significant self- or peer-assessed change in the Teamwork competency, and 3) students exhibited peer-assessed statistically significant growth in the Professionalism competency. The quantitative phase also used a reliability analysis on the Communication, Teamwork, and Professionalism assessment scales to ensure the items on each scale were consistently measuring attributes of each of the three competencies. All the scales had a Cronbach's α >.80, indicating that all scales had good reliability/internal consistency. This consistency

indicates the measurements are reliable and the items on the scales measure the same characteristic (PAS items measure Professionalism; TPS items measure Teamwork; CAT items measure Communication).

The qualitative phase of the study involved thematic analysis of students' 3-part competency development portfolio (CDP) entries to determine what skills students believed they already possessed in each competency, what skills they believed they needed to improve upon, and how they felt about their progression in each competency. The qualitative analysis revealed three main themes for each competency: Imparting Information, Gathering of Information, and Team Communication skills within the Communication competency; Collaboration, Team Engagement, and Conflict/Problem Solving skills within the Teamwork competency; and Interpersonal Relations/Social, Responsibility, and Gross Anatomy lab skills within the Professionalism competency. Within these themes, students discussed their strengths and weaknesses, set goals to improve upon their weaknesses, and reflected on progression through those goals over the course of the semester.

7.2. Discussion

This study has several perceived strengths due to the outcomes and findings reported in this dissertation. The use of mixed methods assessment, how the study moved beyond the 'medical model' of medical education research (Biesta & van Braak, 2020), and the curricular changes introduced as a part of the study aligned with the mission and goals of the University of Louisville School of Medicine (ULSOM) and Liaison Committee on Medical education (LCME) suggestions.

Hoang and Lau (2018) described how, even though CBME is being widely implemented across medical institutions, there are still two major problems that have not yet been solved: reductionism and loss of authenticity, which each present significant challenges when developing curricula and assessment tools for CBME. To address these problems, having flexibility in competency definitions and using mixed methods in CBME are two starting points (Hoang & Lau, 2018). Reductionism in CBME is a major issue; if researchers and preceptors who implement CBME reduce competence into just pieces of measurable performance, this will result in atomization or objectification of higher-order competencies (Hoang & Lau, 2018). This can remove authenticity from learning and cause a reliance on checklists rather than holistic assessments of competence. Reductionism can result in losing sight of the immeasurable aspects of competence (Hoang & Lau, 2018). Therefore, research surrounding CBME needs to be open to diversity in methodological approaches and to appreciate the value of integrated methodological values such as mixed methods (Gruppen et al., 2017).

By using qualitative measures of competence as well as quantitative, a more complete data set was provided for this study. Having a qualitative component in competency-based assessment provides a greater depth of feedback. Hoang and Lau (2018) claim this is important because the objective of CBME is not to simply meet the criteria of a competency in a pass-fail fashion, but to develop curricula and assessment tools that allow students to continuously improve their competence. By using qualitative and quantitative assessment, students honed their understanding of their own skill development over time. Holmboe et al. (2017) suggests that since medical trainees will

go on to be unsupervised physicians, it is necessary for them to practice assessing themselves early in their training.

In using mixed methods assessment, the ability to use triangulation proved to be a strength. The qualitative and quantitative data provided a more complete assessment of the medical students' performance. The greatest value of triangulation is that the weaknesses of quantitative analysis were recompensed by qualitative analysis, and vice versa (Hoang & Lau, 2018; Lockyer et al., 2017). Lockyer et al. (2017) claimed that a CBME assessment program should use both structured and unstructured measures valuing quantitative and qualitative data to ensure that the richness and rigor of the data align. This mixed methods study aligned with what the field is requesting of CBME researchers. Hoang and Lau (2018) suitably sum up this perceived strength:

> "The use of mixed methods is the way forward, as that promises to increase accuracy in measurement, to deter reductionism and the loss of authenticity, and to enable the implementation of a feasible form of CBME."

Another strength of this mixed methods study is how it moved beyond the 'medical model' of educational research. Much of the current medical education research is designed to provide proof that specific teaching practices 'work' and aims for generalizable simplicity to encourage application in a wide variety of contexts (Biesta & van Braak, 2020). There are two significant problems with this model of research. The first being a simplistic reference to 'learning' as what education is supposed to bring about and the second being the assumption that there is causal connection between teaching and learning and the main task of medical education research is to make this connection more secure and effective (Biesta & van Braak, 2020). The issue with the

suggestion that teaching is there to bring about student learning is that the language of learning is not adequately precise—the entire point of education is not to ensure that students learn, but rather that they learn *something*, learn it *for a reason*, and learn it *from someone* (Biesta & van Braak, 2020). Biesta and van Braak (2020) list three domains of purpose for education: 1) *Qualification*, which regards providing students with skills, knowledge, and understanding that will qualify them to do 'something,' 2) *Socialization*, which regards providing students with an orientation to a particular field including its professional domains, and initiating students into the ways of being and doing that reflect the norms and values of their particular vocation, and 3) *Subjectification*, which regards encouraging and supporting students to become subjects of their own actions.

Therefore, medical education research garners strength if it moves beyond the one-dimensional research designs that focus on just one of the domains of purpose for education and 'forgets' to explore the interactions between the three, or that continue to investigate the 'impact' on 'learning' without specifying about and for what the learning is supposed to be (Biesta & van Braak, 2020). This mixed methods medical education research study intended not only to explain whether students improve their competence in Communication, Teamwork, and Professionalism over the progression of the gross anatomy course (*Qualification*), it also gave insights into the ways that the curricular interventions and knowledge/development of competencies helps students be, do, and feel like professional medical students (*Socialization*), and how significant this understanding of competency development is for their ability to act and judge in meaningful and responsible ways now and in their future as physicians (*Subjectification)* (Biesta & van Braak, 2020).

Another perceived strength of this study is how the curricular implementations that were a part of this study were in alignment with the mission and goals of the ULSOM and LCME suggestions. In reviewing the school's program objectives and their alignment with the curriculum, the LCME suggested implementing curricular changes to strengthen program objective 8.1: set periodic professional development goals and apply a formal, schedule reflection and revision process to those goals (*School of*, n.d.). The qualitative aspect of this study (CDPs) specifically instructed students to set goals for each competency (including Professionalism) at the beginning of the semester, reflect on and revise those goals at mid semester, and reflect on the progress in each competency and set new goals for continued maintenance of competence post-end of the course. CBME implementation depends heavily on the characteristics of the local institutional culture (Gruppen et al., 2017) and curricular changes must be compatible with the mission and goals of the institution (Nousiainen et al., 2017). Our study had strength in this context.

Possibly the greatest strength of this study is how it contributes to the existing medical education literature. As discussed previously in chapters one and two, a large gap resides in the educational continuity between undergraduate medical education and postgraduate medical education. Undergraduate, postgraduate, and continuing medical education currently function in silos without integrated processes (Nousiainen et al., 2017). For the paradigm shift to CBME to last, Carraccio et al. (2016) describe the three basic tenets of CBME that must be followed: medical education must be based on the needs of society; it must focus on outcomes, not structure or process; and it must be seamless across the continuum from early medical student to senior practitioner. Medical

educators should agree that CBME principles need to be applied to *all* levels of medical education, rather than just one. Nousiainen et al. (2017) claim that CBME should begin in undergraduate training and seamlessly extend into residency, fellowship, and independent practice. This will result in "educational continuity" which will be advantageous for not only the medical trainees and their preceptors, but for the core reason for enhancing medical education in the first place: the patients. This study adds to the (currently minimal) evidence of including CBME in basic sciences instruction in undergraduate medical training.

More specifically, this study addressed a particular aspect of CBME that Gruppen et al. (2017), on behalf of the International Competency-Based Medical Education (ICBME) Collaborators, claims requires research. Gruppen et al. (2017) claim that it is important to understand the characteristics of learners, how they behave in a CBME environment, and how their empowerment can be achieved. They suggest that a possible direction for research in this regard is to study the role of self-assessment and self-regulated learning in the pursuit and maintenance of competence (Gruppen et al., 2017). This study evaluated the students' quantitative and qualitative self-assessments and demonstrated the importance of self-assessment in the pursuit and maintenance of competence. The students' personal beliefs and judgments within their reflections are important to their decisions regarding where and how to focus their competency education time and effort as well as how to solicit and use feedback most effectively (Gruppen et al., 2017).

Gruppen et al. (2017) suggests that for practical and theoretical reasons, a better understanding of the dynamic relationship between performance feedback generated by

oneself and that which is generated by someone else and how both of those sources of feedback influence one's efforts to become more competent, is necessary to discover through CBME research. During the CADE course, faculty comments and self-/peer-assessments were utilized to create formative and summative feedback for each student at the beginning and end of the course so students could see how their peers and preceptors perceived their competency development compared to how they themselves see their competency development. The qualitative data provided in the students' CDPs illustrated the efforts made by students to become more competent and their feelings toward the feedback they received at mid and end of semester. Thus, this study aimed to address this research topic within CBME.

Overall, while the study has several perceived strengths, there are several noted limitations to its data collection and analysis methods, threats to internal validity such as assessment fatigue and social desirability bias, and generalizability. These are described in Chapter 3 under Ethical Considerations as well as in the Limitations section below. However, communicating uncertainty and limitations explicitly will aid in the advancement of critical understanding of the nature and implications of emerging knowledge in the research field of CBME (Helmich et al., 2015). It is necessary to remember that there will always be something innumerable and immeasurable about the service that a physician provides (Hoang & Lau, 2018), which is why utilizing mixed methods is a substantial strength of the study. The overarching goal of this study was to meaningfully contribute to research in CBME by adopting the strategy of "beginning with the end in mind" which, if adopted by other researchers as well, will allow the entire

continuum of medical education, training, and practice to be informed by a shared vision of what it means to be a good doctor (Carraccio et al., 2016).

Limitations

While all attempts were made to minimize potential limitations and potential sources of bias, we acknowledge that this study was limited by many factors. First, the study was conducted at a single undergraduate medical education institution; therefore, these results may not be generalizable to first-year medical students at other medical schools. Other potential limitations are selection bias, potential assessment fatigue, and the study utilized and analyzed graded assignments from a course.

This study examined curricular implementations which were graded assignments in the CADE course in the fall of 2022. The study was IRB-approved to analyze these assignments after the conclusion of the CADE course in December of 2022. Because we had to rely on the data that were available, we did not collect any additional data. This resulted in missing data points for several students in the study population and thus limited the number of students that could be included in the study. If a student did not complete all competency-based assignments, their data were removed from analysis. Therefore, the size of the sample was limited by the number of students who had completed all their self-assessment assignments and CDP entries and received all their peer-assessments, as the researchers were most interested in students with a complete story composed of self- and peer-assessments with reflective CDPs. This methodology had the potential to introduce selection bias which can affect generalizability. It is possible that those who were omitted from the study had limited professional, teamwork, or communication skills, which would result in skewed and biased results. However,

additional quantitative analyses on the omitted student data were conducted and demonstrated comparable findings for the self- and peer-assessment dependent *t*-tests of Communication and Professionalism, with the exception of the Teamwork peer-assessment, which indicated growth from Time 1 to Time 2 with a *p* value of .007 compared to the study population *p* value of .055. The quantitative and qualitative analyses on the study population for Teamwork indicated that Teamwork is a complex construct that requires further investigation.

Over the course of the semester, students were asked to submit six self-assessments, three reflective portfolio entries with two questions per competency per entry, and up to fourteen peer-assessments. The high number of assessments may have resulted in students developing assessment fatigue, particularly as the semester progressed. Rather than reporting the 'true assessment score' students may have felt tired and completed the assignments just to check them off their to-do list rather than to sit with and reflect on their importance as they were instructed. This may have resulted in students not responding truthfully to the surveys and CDPs as the semester progressed, which may have resulted in overinflated values if the 'fatigued' score is higher than the 'true score' or underinflated values if the 'fatigued score' was lower than the 'true score'. Ultimately, this potential fatigue may have affected the value of the quantitative competency score and the identified themes in the qualitative data assessment. However, to help ease this fatigue the pretest and posttest surveys and CDP entries were deliberately spread out over the course to allow for short breaks between data collection periods. Also, a grade was assigned to students for completion of these assessments in an effort to highlight the importance and gravity of the assignments.

Using assignments from the CADE course as the data materials for this study presents another study limitation. While students were likely more inclined to complete the self- and peer-assessments and CDPs because they were graded assignments (as opposed to optional surveys/reflections), their grades came from completion rather than from quality of assessment/reflection. For feedback on the CDP entries during the semester, students received a rubric that indicated whether they had met, exceeded, or failed to meet expectations with their answers to the CDP questions, but their scores on that rubric did not influence their grade on the assignment. The rubric was provided as a formative feedback tool for students to see if they had addressed all aspects of the assignment. Knowing that faculty would be seeing the results of the self- and peer-assessments and CDPs could have resulted in students' scoring each other and themselves highly so as to appease the faculty who would grade the assignments (social desirability bias: Ross and Bibler Zaidi (2019)), or in students giving basic rather than rich descriptions in their reflective CDP entries (e.g., "I believe I have improved my Communication skills" versus "I believe one of my biggest improvements to communication, since August, is asking follow up questions to make sure my classmates understand what I'm trying to convey during peer teaching."). This could have affected our study since the averages of all the quantitative assessments were at least a score of 4.5, and students generally discussed improvements in skills within each competency on their CDPs. However, our data indicate variability in the competency assessments, rather than universal growth from the pre- to post-assessments, or students giving themselves and/or their peers consistent scores of 5 on each assessment. Even though students rated

themselves highly, there was still variability in the data and growth was only observed in the Communication self- and peer-assessments and Professionalism peer-assessments.

Future Research

To our knowledge, this has been the first study to assess first-year medical students' Communication, Teamwork, and Professionalism competency development quantitatively and qualitatively in the gross anatomy lab context over time. This study has provided insights into how these students self- and peer-assess and reflect upon their competency development and it has demonstrated how peer teaching can be a valuable tool for improving the Communication competency. The study has also unveiled a multitude of questions about how to improve the assessment of Teamwork and Professionalism in the gross anatomy lab context, as well as other questions regarding how this competency-based curriculum in the gross anatomy lab context can be improved upon. Key areas for future research based on the findings of this study are discussed below.

For this study, peer teaching, anatomy team charters (ATCs), and day-to-day activities in the gross anatomy lab were used as the interventions, or tools, to address Communication, Teamwork, and Professionalism competency development, respectively. These interventions occurred between pretest/posttest and CDP entries. The study clearly demonstrated that peer teaching was perceived by students as a successful tool to improve their Communication competency, and this was demonstrated in the CAT-SA and CAT-PA dependent *t*-tests. However, future research is necessary to address the stagnancies found in the Teamwork and Professionalism competencies in this study.

Due to research indicating that team charters can be important instructional tools for improving team quality (Aaron et al., 2014; Cox, 2016; Dougherty et al., 2018; Hunsaker et al., 2011), we anticipated that having the students develop ATCs within their dissection teams at the beginning of the semester and then revisit and revise their ATCs at mid semester would result in students perceiving self- and peer-improved teamwork skills by the end of the semester. However, the TPS-SAs and the TPS-PAs indicated stagnancy, and students seldom discussed their ATCs in their CDPs. Students were not specifically instructed to reflect on the utility of their ATCs; however, if the students believed that the ATCs were beneficial or were their reasoning for improving their Teamwork skills, it is fair to assume that they would have discussed them in their Teamwork CDPs similarly to how they discussed peer teaching within their Communication CDPs. This indicates that students either did not perceive their ATCs to be a contributing factor to the development of their teamwork skills, or that students did not use their ATCs to the best of their abilities. In order to truly assess the effectiveness of a team charter in improving teamwork skills, future research could examine if correlations exist between successful (or unsuccessful) team charter implementations with other measurable aspects of teamwork skills using validated teamwork assessment scales. A study could ask students individually about the utility of their charters and whether they believed the charters assisted in improving teamwork skills, and then compare those responses to team and/or individual quantitative measurements of teamwork skills.

Due to expanding literature identifying that dissection-based gross anatomy courses are a perfect, early opportunity for teaching professionalism within medical

education (Escobar-Poni & Poni, 2006; Evans et al., 2018; McDaniel et al., 2021; Palmer et al., 2020), we hypothesized that the day-to-day activities in the ULSOM gross anatomy course (e.g., care for anatomic donor, punctuality, etc.) would contribute to students' understanding of and improvement within the Professionalism competency. Because it has been concluded that no individual tool can reliably and effectively measure students' professionalism (Palmer et al., 2020), we used a multi-tool approach (self- and peer-assessments and CDPs) to assess the complex and situational nature of professionalism in the gross anatomy lab context. Our peer-assessment and CDP findings indicated that students perceived themselves and their peers to have gained skills in Professionalism over the course of the semester. The literature claims that peer-assessment should be at the forefront of the professionalism assessment process due to it being found to be successful in monitoring students' professional values and improving professionalism (Bryan et al., 2005; Palmer et al., 2020; Spandorfer et al., 2014). Self-reflection, such as in the form of portfolio pieces, has also been found to be a key tool for teaching professionalism, and physicians' ability to reflect has been associated with the improvement of patient care (Palmer et al., 2020).

However, like with other studies that used self- and peer-assessments to assess professionalism (Bryan et al., 2005; Hoffman et al., 2017), our study found that the students' underrated themselves on their self-assessments compared to the ratings they received from their peer-assessments. This indicates that peer-assessment skills may not be transferable to self-assessment skills (Bryan et al., 2005). While students may have more inclination to assess their peers in an objective manner, their self-assessments are more critical, which may reflect students' reluctance to praise themselves while being

more comfortable commending their peers (Bryan et al., 2005). Lack of experience using quantitative self-assessments and unrealistic expectations of their own abilities as first-year medical students may also contribute to this observed difference (Bryan et al., 2005). Future research could, therefore, focus on developing students' abilities to quantitatively self-assess professionalism more critically and effectively. Due to peer-assessment being found to be more reliable and accurate than self-assessment (Ward et al., 2002), future studies could use quantitative peer-assessment as a 'control' condition to evaluate quantitative self-assessment against. Our study did not attempt to compare the self-assessments with the peer-assessments for each competency, as that was not the intent of the study. Future studies could examine how the peer-assessments compare to the self-assessments to add to the literature on peer- versus self-assessment.

For our study, peer-assessment was utilized as a tool to provide students with feedback on their competencies' progression throughout the semester, and to see if students perceived their peers to have improved upon their skills from the beginning of the semester to the end. We were encouraged to use peer-assessments as feedback by several studies in the literature. For example, a study by Andrew Jay et al. (2013) utilized third year medical students as peer teachers in the gross anatomy lab for first-year medical students. A survey assessment indicated that twenty-one of the twenty-five peer teachers agreed or strongly agreed that they improved at giving negative feedback to students (their peers) and twenty-three of the twenty-five agreed or strongly agreed that they improved at giving positive feedback to students (Andrew Jay et al., 2013). Another study by Spandorfer et al. (2014) utilized peer-assessment in their anatomy course and found that 76% of the class agreed or strongly agreed with the statement "Based on the

feedback I received, I made a change in how I worked with or taught my peers." Our study gives further insight into how students perceive faculty and peer-assessment feedback, with students being largely unsurprised by and happy with the feedback they received and some indicating that their feedback reflected improvements within each competency (Tables 4.14, 4.19. 5.14, 5.21, 6.14, 6.19).

A future study that would be particularly interesting would be to examine the students who did *not* complete all the competency-based assignments in the fall of 2022 to see if there is a correlation to professionalism or other competency deficiencies for those students in their clerkship/residency years. Future studies could also look at the differences in competency development between genders, academic performance scores, and previous experience prior to entering medical school.

7.3. Conclusions

The findings of this study should be used to guide the efforts of medical educators in teaching and assessing competencies such as Communication, Teamwork, and Professionalism within the preclinical years of medical education. Dissection-based gross anatomy laboratories with faculty who are willing to implement the education and assessment of nontraditional discipline-independent skills (Evans et al., 2018) can be the perfect place of opportunity for implementing competency-based assessment to further promote the educational continuity from undergraduate medical education and beyond. This study has provided several pieces of evidence for the implementation of CBME in a gross anatomy course being feasible and beneficial to first-year medical students: 1) implementing peer teaching as a tool for increasing Communication skills in the dissection-based gross anatomy course is successful and improves student confidence,

preparation abilities, pace of information delivery, ability to ask questions, and use of appropriate anatomic language, 2) when students are tasked with setting goals for improving weaknesses in competencies, then revising, and reflecting on those goals over the course of the semester, they actively choose to work on those weaknesses and reflect on the skills they developed over the course that they deem are necessary to their future as physicians, and 3) when students are given faculty and peer-assessment feedback on their behaviors, they respond positively and gratefully. These are all indications that the gross anatomy lab can be a venue for competency-based assessment in UME that aligns with competency-based assessment in graduate medical education (GME).

While many educators may be apprehensive to alter their gross anatomy curricula to include the assessment of discipline-independent skills, the ULSOM first-year medical educators are taking this challenge head-on. Anatomy educators must understand their responsibilities lie not only as teachers of anatomical content, but also as role models whose values, attitudes, and behaviors contribute to shaping first-year medical students' professional identities and thus these educators should constantly display the same professional behaviors expected from students (Palmer et al., 2020). We have an obligation to use and/or develop tools for instilling professional values and the importance of teamwork, communication, and reflective practice within first-year medical students. This study has demonstrated how multiple competencies can be addressed and assessed separately in the gross anatomy lab context, and we hope that other anatomy educators will see the necessity of furthering this research topic and contributing to the literature on incorporating CBME in dissection-based gross anatomy laboratories across the United States.

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APPENDICES

APPENDIX A

List of Abbreviations

AAMC – Association of American Medical Colleges

ACGME – Accreditation Council for Graduate Medical Education

ATC – Anatomy Team Charter

CADE – Clinical Anatomy, Development, and Examination course

CAT – Communication Assessment Tool

CAT – Communication Assessment Tool Peer-Assessment

CAT-SA – Communication Assessment Tool Self-Assessment

CBME – Competency-Based Medical Education

CDP – Competency Development Portfolio

GME – Graduate Medical Education

PAS – Professionalism Assessment Scale

PAS-PA – Professionalism Assessment Scale Peer-Assessment

PAS-SA – Professionalism Assessment Scale Self-Assessment

PGME – Post-graduate medical education

TPS – Teamwork Performance Scale

TPS-PA – Teamwork Performance Scale Peer-Assessment

TPS-SA – Teamwork Performance Scale Self-Assessment

ULSOM – University of Louisville School of Medicine

UME – Undergraduate Medical Education

APPENDIX B

Communication Assessment Tool (CAT) Instruments

Lab Competency: Communication

While peer teaching is used in our laboratory primarily to inform, for example, Group A's dissection of structures to Group B, peer teaching in the Gross Anatomy laboratory is also a perfect place of opportunity for first-year medical students to practice interpersonal communication. In peer teaching scenarios, the peer teacher should act as the 'physician' informing their professional peers about a "case" (donor anatomy). Therefore, this semester, you will be assessing your and your peers' communication skills during these peer teaching interactions. This is to help prepare you for residency, as one of the six ACGME core competencies is Interpersonal and Communication skills. For these assessments, we will be using the Communication Assessment Tool (CAT) adapted from Trickey et al., 2016. It is to your benefit to assess yourself and your peers as honestly as possible. Your responses will not be shared with your peers—they will be incorporated into a holistic assessment of this competency for this individual.

Communication Assessment Tool (CAT) adapted from Trickey et al., 2016.

PEER-ASSESSMENT:

Communication with your professional peers is a very important part of quality medical care. Please use this scale to rate the way your Peer Teacher communicated with you. Your answers are completely confidential, so please be as open and honest as you can.

	1	2	3	4	5
1)This peer teacher greeted me in a way that makes me feel comfortable.	Encounter(s) with this peer teacher are awkward/uncomfortable.		You felt as though this peer teacher behaved professionally and respectfully		You felt very comfortable in this peer teacher's presence as soon as you met them.
2)This peer teacher treated me with respect.	You felt rushed, not necessarily heard, and even dismissed		This peer teacher looked you in the eye, used your name, and behaved respectfully.		This peer teacher made you feel as though you were a very important member of this team and that your concerns and knowledge/

					views/values were important.
3)This peer teacher shows interest in my ideas/questions.	Did not seem to care; did not ask if you had questions		Asked about your ideas/questions; Expressed interest		Followed up with more questions about your ideas/questions. Encouraged you to explore your thoughts, not just re-explain them.
4)This peer teacher understood my main concerns/questions.	You think if you asked the peer teacher what your main concerns/questions were, they would not guess correctly.		The peer teacher asked and seemed to understand your concerns/questions.		The peer teacher followed up with your main concerns/questions and helped you think more in-depth about them.
5)This peer teacher paid attention to me (looked at me, listened carefully).	Limited eye contact.		Good eye contact.		Good eye contact. Waited a while after I spoke to see if I had more to add. Encouraged me to engage.
6)This peer teacher let me talk/ask questions without interrupting me.	Peer teacher did most of the talking. Interrupted ("knew" what you were going to say)		Peer teacher interrupted occasionally but allowed me to talk sometimes.		Peer teacher always waited for you to finish your thought, then waited a little longer. Never interrupted.
7)This peer teacher gave me as much information as I wanted/needed.	You have lots of questions/uncertainty left		Peer teacher answered all your questions.		You feel you have as much information as you could have at this point.
8)This peer teacher talked in terms I could understand.	You were left feeling confused about what they were saying, but it sounded smart.		You pretty much understood everything the		You not only understood what the peer teacher told you, but you

			peer teacher told you		could explain what the peer teacher told you to your team members.
9)The peer teacher checked to be sure I understood everything	Never asked "does this make sense?"		Checked in—"Do you understand/have any questions?"		Not only checked in with you, but you felt they were ready to re-explain and be helpful.
10)This peer teacher encouraged me to ask questions.	Never asked if you had questions.		Asked if you had any questions		Peer teacher helped you think about more questions you might have even after all other questions were answered.
11)This peer teacher explained their team's decisions as much as I wanted/needed.	Peer teacher did not explain what their dissection team did (steps taken during dissection).		Peer teacher briefly explained their team's decisions and dissection steps/tricks to find structures.		You feel as though you understand and could do the dissection that the peer teacher's team did based on the peer teacher's explanation.
12)This peer teacher discussed next steps/any structures their team did not uncover.	Never discussed next steps. Did not note that some structures were not found by their team.		Discussed next steps. Briefly noted structures not uncovered.		You helped the peer teacher come up with next steps/how to find the uncovered structures after you reviewed the options with them.
13)This peer teacher showed care and concern.	Little eye contact. Rushed. Brisk.		Seemed concerned for		You felt as though the peer teacher was

			your understanding.		concerned for your understanding.
14)This peer teacher spent the right amount of time with me.	You felt rushed. Your peer teacher spent little time with you.		You felt the peer teacher took time with you.		You felt the peer teacher utilized adequate time to explain and answer questions.

SELF-ASSESSMENT:

Communication with your professional peers is a very important part of quality medical care. Please use this scale to rate the way you communicate with your professional peers. Your answers are completely confidential, so please be as open and honest as you can.

	1	2	3	4	5
I greeted my peers in a way that made them feel comfortable	I did not introduce myself or try to relate to my peers.		I professionally and respectfully greeted my peers.		I went above and beyond to address my peers by name and make them feel comfortable and seen.
I treated my peers with respect.	I rushed and was dismissive of my peers.		I used eye contact, my peers' names, and behaved respectfully.		I made my peers feel as though they were a very important member of this team and that their concerns and knowledge/views/values were important.
I showed interest in my peers' ideas/questions.	I did not address or ask if my peers had ideas/questions.		I asked my peers about their ideas/questions; Expressed interest.		I followed up with more questions about my peers' ideas/questions. Encouraged my peers to explore their thoughts, not just re-explain them.

I understood my peers' concerns.	I did not address or ask for my peers' concerns		I addressed my peers' concerns/questions and tried to understand them.		I followed up with my peers about their main concerns/questions and helped them think more in-depth about them.
I paid attention to my peers (looked at them, listened carefully).	Little to no eye contact		Maintained good eye contact.		Maintained eye contact. Waited a while after my peers spoke to see if they had more to add. Encouraged my peers to engage.
I let my peers talk without interrupting them.	I did most of the talking.		I interrupted my peers occasionally.		I always waited for my peers to finish their thoughts. Never interrupted.
I gave my peers as much information as they wanted/needed.	I did not check to see if my peers had any uncertainty/questions.		I answered all my peers' questions.		I answered all my peers' questions and gave extra information to ensure my peers understanding.
I talked in terms that my peers could understand.	I did not speak carefully or use appropriate language/descriptive anatomical terms.		I used appropriate language and descriptive terms.		I took great care to talk in terms my peers could understand using appropriate language, anatomical terms, and body language.
I checked to be sure my peers understood everything I said.	Never checked in or asked, "does that make sense?"		Checked in with my peers— "Do you understand/does that make sense?"		Not only checked in with my peers but was ready to re-explain and be helpful if needed.
I encouraged my peers to ask questions.	Never asked my peers if they had questions.		Occasionally asked if my peers had questions.		Frequently asked if my peers had questions. Helped peers think of more questions they might have even after all other questions were answered.

I explained my team's dissection decisions as much as my peers wanted/needed.	Did not explain my dissection team's process.		briefly explained my team's decisions and dissection steps/tricks to find structures.		I thoroughly explained my dissection team's decisions/process and believe my peers could do the dissection themselves based on my teaching.
I discussed next steps/any structures that my team did not uncover.	Never discussed next steps. Did not note that some structures were not uncovered by my team.		Discussed next steps. Noted some structures my team did not uncover.		I asked my peers to help come up with next steps/how to find the uncovered structures after reviewing the options with them.
I showed care and concern for my peers understanding.	Little eye contact. Rushed. Brisk.		Acted concerned for my peers understanding		Was genuinely concerned for my peers understanding
I spent the right amount of time with my peers.	I rushed.		I took time with my peers.		I utilized adequate time to explain and answer my peers' questions.

APPENDIX C

Teamwork Performance Scale (TPS) Instruments

Lab Competency: Teamwork

Teamwork is an integral part of your future careers as physicians, as well as in the Gross Anatomy laboratory as first-year medical students. You will be with the same team of 3-4 individuals throughout the entire semester, dissecting together at least once a week, and creating and adhering to an Anatomy Team Charter together. One of the ACGME six core competencies is Systems-based Practice, which involves working in inter-professional teams to enhance patient safety and improve patient care quality. Thus, we intend to help you build your teamwork skills to prepare you for residency and excelling in this competency. This semester, you will be assessing your and your teammates' teamwork skills using the Team Performance Scale (TPS) adapted from Thompson et al., 2009. It is to your benefit to assess yourself and your peers as honestly as possible. Your responses will not be shared with your peers—they will be incorporated into a holistic assessment of this competency for this individual.

Teamwork Performance Scale (TPS) adapted from Thompson et al., 2009.

PEER-ASSESSMENT:

Based on your **OVERALL** experience with this teammate so far, please estimate **HOW OFTEN** the following events occurred using the scale: 1 = Not yet; 3 = Some of the time; 5 = All of the time. Your answers to these items will be confidential and will **NOT** be shared with your fellow team members.

	Not yet		Some of the time		All of the time
Team member makes an effort to participate in discussions.	1	2	3	4	5
Team member encourages other team members to express their opinions and thoughts.	1	2	3	4	5
Team member shares and receives criticism without making it personal.	1	2	3	4	5
Different points of view are respected by this team member	1	2	3	4	5

Team member often helps fellow team members to be understood by paraphrasing what they say.	1	2	3	4	5
Team member uses several techniques for problem solving (such as brainstorming) by presenting their best ideas.	1	2	3	4	5
Team member works to come up with solutions that satisfy all team members.	1	2	3	4	5
Team member consistently pays attention during group discussions/dissections.	1	2	3	4	5
Team member actively elicits multiple points of view before deciding on a final answer.	1	2	3	4	5
Team member listens when someone on the team expresses a concern about individual or team performance.	1	2	3	4	5
Team member willingly participates in all relevant aspects of the team.	1	2	3	4	5
Team member resolves differences of opinion by openly speaking their mind.	1	2	3	4	5
Team member uses feedback about individual or team performance to help the team be more effective.	1	2	3	4	5
Team member seems attentive to what other team members say when they speak.	1	2	3	4	5
Team member is able to resolve conflicts by compromising with other team members.	1	2	3	4	5
Team member explains their point of view to the team when they have a different opinion than the rest of the team.	1	2	3	4	5
Team member is recognized when something they said helped the team reach a good decision.	1	2	3	4	5

SELF-ASSESSMENT:

Based on your **OVERALL** experience being a teammate so far, please estimate **HOW OFTEN** the following events occurred using the scale: 1 = Not yet; 3 = Some of the time; 5 = All of the time. Your answers to these items will be confidential and will **NOT** be shared with your fellow team members.

	Not yet		Some of the time		All of the time
I make an effort to participate in team discussions.	1	2	3	4	5
I encourage team members to express their opinions and thoughts.	1	2	3	4	5
I share and receive criticism without making it personal.	1	2	3	4	5
I respect different points of view of my team members.	1	2	3	4	5
I help fellow team members to be understood by paraphrasing what they say.	1	2	3	4	5
I use several techniques for problem solving (such as brainstorming) and present my best ideas to the team.	1	2	3	4	5
I work to come up with solutions that satisfy all team members.	1	2	3	4	5
I consistently pay attention during group discussions/dissections.	1	2	3	4	5
I actively elicit multiple points of view from my team members before deciding on a final answer.	1	2	3	4	5
I listen to my team members when someone expresses a concern about individual or team performance.	1	2	3	4	5
I willingly participate in all relevant aspects of the team.	1	2	3	4	5

I resolve differences of opinion by openly speaking my mind.	1	2	3	4	5
I use feedback about my individual or team performance to help the team be more effective.	1	2	3	4	5
I am attentive to what other team members are saying when they speak.	1	2	3	4	5
I assist in resolving conflicts by compromising with my team members.	1	2	3	4	5
If I have a different opinion than my team members, I explain my point of view to the team.	1	2	3	4	5
I recognize my team members when something they say helps the team reach a good decision.	1	2	3	4	5

APPENDIX D

Professionalism Assessment Scale (PAS) Instruments

Lab Competency: Professionalism

Professionalism is an integral part of your future careers as physicians, as well as in the Gross Anatomy laboratory as first-year medical students. Unprofessional behavior is the single most common cause for disciplinary action against medical students in their clinical rotations, residents, and clinical practitioners (Escobar-Poni and Poni, 2006). One of the ACGME six core competencies is Professionalism, which is manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population. The first two years of medical school can (and should) provide foundational assessment and reflection of ethics and professionalism necessary to continue medical training in the subsequent years. Epstein and Hundert (2002) proposed the following definition regarding professional competence: "the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served."

Thus, we intend to help you assess and build your professionalism skills to prepare you for residency and excelling in this competency. This semester, you will be assessing your and your peers' professionalism skills using the Professionalism Assessment Scale (PAS) adapted from Hammer et al., 2000. It is to your benefit to assess yourself and your peers as honestly as possible. Your responses will not be shared with your peers—they will be incorporated into a holistic assessment of this competency for this individual.

Professionalism Assessment Scale (PAS) adapted from Hammer et al., 2000.

PEER AND SELF-ASSESSMENT:

PEER: Based on your **OVERALL** experience with this teammate so far, please use this scale to rate your peers' behavioral professionalism. Your answers to these items are completely confidential and will **NOT** be shared with your fellow team members, so please be as open and honest as you can.

SELF: Please use this scale to rate your behavioral professionalism as it relates to your experience in the Gross Anatomy laboratory so far. Your answers to these items are completely confidential and will **NOT** be shared, so please be as open and honest as you can.

	1	2	3	4	5
Student is reliable and dependable	Cannot be counted on to fulfill responsibilities; does not meet expectations				Can be counted on to fulfill all responsibilities and exceed expectations
Student produces quality work	Dissection tasks are incomplete such that all checklist structures are not fully cleaned/exposed (e.g., only one upper limb is fully dissected)				Dissection tasks are performed meticulously in terms of exposing checklist structures and key anatomic relationships are visible (e.g., subcutaneous tissue removed)
Student is empathetic	Does not demonstrate appreciation of others' positions; rarely attempts to identify with others' perspectives; is not considerate towards others				Demonstrates appreciation of others' positions; attempts to identify with others' perspectives; demonstrates consideration toward others
Student behaves in an ethical manner	Demonstrates one or more behaviors that are not consistent with principles of conduct expected of a first-year medical student at UofL School of Medicine				Consistently demonstrates all principles of conduct expected of a first-year medical student at UofL School of Medicine.
Student communicates articulately	Does not clearly communicate; uses inappropriate terminology, vocabulary, and/or language				Clearly communicates thoughts; uses appropriate terminology, vocabulary, and language for the Gross Anatomy laboratory
Student is punctual	Arrives to the Gross Anatomy laboratory and/or team meetings late; does not complete tasks and/or delegated responsibilities (e.g., does not complete what is required of them for the dissection)				Arrives to all Gross Anatomy laboratory and team meetings early or on time; meets deadlines for completion of tasks and delegated responsibilities (e.g., completes what is required of them for the dissection)
Student uses time efficiently	Does not time manage effectively or efficiently; gives little to no care for team members' time				Allocates and utilizes appropriate amounts of time to fulfill responsibilities; utilizes team members' time wisely

Student is self-directed in undertaking tasks	After initial instruction of tasks/assignments/responsibilities, does not initiate activities to complete them; has little to no self-motivation; little to no ability to function independently				After initial instruction of tasks/assignments/responsibilities, initiates activities to complete them; self-motivated; functions independently; seeks additional tasks after completing originals.
Student maintains confidentiality	Engages in discussion or other activities involving cadaver donors- and/or team-specific information for inappropriate purposes; does not maintain confidential nature of cadaver- and/or lab/team-specific documents				Engages in discussions or other activities involving cadaver donors- and team-specific information for purposes of fulfilling professional responsibilities only; maintains confidential nature of cadaver- and lab/team-specific documents
Student is respectful	Demonstrates disrespect toward the cadavers and/or superiors, colleagues, other personnel, and lab space.				Demonstrates appropriate regard for cadavers, superiors, colleagues, other personnel, and lab space; acts in a manner that shows recognition that they are privileged to work with cadaver donors as a professional student
Student communicates using appropriate body language	Utilizes inappropriate gestures and/or mannerisms unacceptable for formal and informal communication in the Gross Anatomy lab/team settings.				Utilizes gestures and mannerisms that enhance formal and informal communication in the Gross Anatomy lab/team settings.
Student demonstrates accountability	Blames others for mistakes or mishaps; avoids responsibilities				Holds oneself liable for tasks/duties/responsibilities that they are responsible; does not blame others for mistakes or mishaps, nor avoids responsibilities
Student prioritizes responsibilities effectively	Disorganized; unable to approach multiple tasks in a manner to produce desired outcomes (e.g., focuses on previous lab material rather than completing what				Organizes and approaches multiple tasks and assignments in a manner to produce desired outcomes (e.g., focuses on appropriate lab material to

	dissection is required during their scheduled lab time)				complete what is required during scheduled lab times)
Student accepts and applies constructive criticism	Struggles to accept constructive criticism, continues inappropriate or unacceptable behavior				Responds openly and positively to feedback; modifies behavior if necessary
Student puts others' needs above their own	Does not regard others' when asked for help; shows no willingness to help others; acts selfish rather than selfless				Demonstrates an attitude of service by taking the necessary time and actions to help others; gives oneself to benefit of others; shows willingness to help others before being asked for help
Student is nonjudgmental	Demonstrates an attitude of closed-mindedness towards others and situations; "stereotypes" others/seemingly prejudges situations				Demonstrates an attitude of open-mindedness towards others and situations; does not "stereotype" others or prejudge situations
Student communicates assertively	Communicates in an inappropriate or even aggressive manner during dialogue or discussions; or communicates very passively				Actively and appropriately engages in dialogue or discussions; not afraid to provide their viewpoint
Student is an active learner	Expects for information to be handed to them; places responsibility for own learning on peers or superiors (e.g., faculty/lab instructors); passively engages in lab (e.g., infrequently dissects and leaves it to teammates)				Seeks knowledge, asks questions; searches for information; takes responsibility for own learning; frequently dissects
Student is cooperative	Argumentative; unwilling and unhelpful				Non-argumentative; consistently willing and helpful
Student is diplomatic	Behaves in an unfair manner in dealings with cadavers, superiors, colleagues, and other personnel (e.g., dominates the dissection and				Is fair and tactful in all dealings with cadavers, superiors, colleagues, and other personnel (e.g., does not dominate the dissection, fairly allots time to others)

	does not allow others to participate)				
Student "follows through" with responsibilities	Leaves tasks incomplete/problems unresolved and does not explain situation to the necessary parties (e.g., does not communicate to lab table mates that their dissection was incomplete)				Completes all that is required of them; or, if task is left incomplete or problem is not resolved, student seeks aid or explains situation to parties who can follow-up on task or problem (e.g., lab table mates)
Student wears appropriate attire	Does not adhere to Gross Anatomy lab dress code (e.g., wears open-toed shoes, hats, shorts, etc.)				Consistently adheres to Gross Anatomy lab dress code (e.g., wears gloves, close-toed shoes, etc.)
Student demonstrates confidence	Acts and communicates in an arrogant or overconfident manner				Acts and communicates in a self-assured manner, yet with modesty and humility
Student demonstrates a desire to exceed expectations	Demonstrates no desire to exceed expectations				Goes "above and beyond the call of duty"; strives to exceed minimal standards and requirements for tasks/assignments/responsibilities

APPENDIX E

Competency Development Portfolios (CDPs)

Competency Development Portfolios (CDPs)

Medical education is shifting toward a competency-based paradigm internationally and has especially gained traction in the United States in recent years. Currently, the AAMC, ACGME, and AACOM are developing an initiative to create a common set of foundational competencies for use in undergraduate medical education programs in the US as a comprehensive effort to improve the transition from medical school to residency. With the influence of the current AAMC competencies for entering medical school and the ACGME six core competencies for medical residents, we have chosen three competencies to be assessed of first-year medical students in the Gross Anatomy laboratory.

You are now aware that this semester aspects of competency based medical education (CBME) are being introduced into our gross anatomy lab curriculum. The competencies of Communication, Teamwork, and Professionalism are essential to your growth as a medical student and eventual practicing physician, and the gross anatomy laboratory is an opportune place to begin your development in- and understanding of these competencies as they relate to the medical profession and your experience as a medical student.

We are introducing the concept of a Competency Development Portfolio, intended to help you 1) document your goals for each competency this semester; 2) revise and reflect on those goals and track progress in each competency 3) and self-reflect and plan for continued maintenance of each competency as you progress through your medical education.

Here are our working definitions of each competency as they relate to your experience in the gross anatomy laboratory:

Communication:

- ability to effectively peer teach through explanation, listening and influencing.
- ability to communicate using appropriate non-verbal behaviors.
- ability to navigate interpersonal conflict amongst team members.
- ability to establish a rapport with team members
- *Also refer to the CAT rubric descriptions*

Teamwork:

- ensure equitable distribution of dissection duties, with entire team sharing in various roles and taking turns performing these tasks.
- support one another's progress.
- work to ensure success of the team as a whole.
- provide appropriate feedback to team members on attributes relevant to the lab setting

- *Also refer to the TPS item descriptions*

Professionalism:

- respect, integrity, responsibility, compassion, commitment to excellence, adherence, sensitivity
    - showing up on time for lab and peer teaching
    - treating all anatomical donors with respect and dignity
    - being honest if a mistake is made
    - acknowledge personal unconscious biases
    - treat colleagues with respect at all times.
    - take prompt action if you believe a colleague is acting unprofessionally
    - uphold safety guidelines by appropriately wearing appropriate protective equipment--gloves and mask-- in lab
- *Also refer to PAS rubric descriptions*

<u>CDP Part One: Goal Setting</u>

Communication –

1. Identify areas of weakness and strength you believe you have in this competency
2. Develop SMART goals related to this competency
    a. E.g., Say your initial goal is to "Be a better communicator"
        i. Add context
            1. Make your goal more specific: think about what it looks like when the communication transpires. What kind of communication is it? Who is your audience? What kind of information is being communicated?
        ii. Determine desired state/actions to achieve your goal(s)
            1. What aspect of communication would you like to improve? Clarity? Comprehensiveness? Eye contact?
            2. How will you attempt to achieve that goal?
        iii. Identify success measures
            1. Think about how you will know if you've communicated successfully.
                a. E.g., Peers verbally indicate to you that they understand everything you've peer taught them

Teamwork –

1. Identify areas of weakness and strength you believe you have in this competency
2. Develop SMART goals related to this competency
    a. E.g., Say your initial goal is to "be a good teammate"
        i. Add context

1. Make your goal more specific: think about what it looks like to be a good teammate, what does that entail?

ii. Determine desired state/actions to achieve your goal(s)
1. What aspect of your teamwork skills would you like to improve? Responsiveness to team members? Ability to confront conflict? Ability to give constructive feedback?
2. How will you attempt to achieve that goal?

iii. Identify success measures
1. Think about how you will know if you are acting as a good teammate
a. E.g., peers verbally indicate that you're helpful in lab and appreciate you as a teammate

Professionalism –

1. Identify areas of weakness and strength you believe you have in this competency
2. Develop SMART goals related to this competency
a. E.g., Say your initial goal is to "always act professionally"
i. Add context
1. Make your goal more specific: think about what it looks like to always act professionally, what does that entail?

ii. Determine desired state/actions to achieve your goal(s)
1. What aspect of your Professionalism skills would you like to improve?
2. How will you attempt to achieve that goal?

iii. Identify success measures
1. Think about how you will know if you are always acting professionally
a. E.g., you consistently show up on time/early; your peers note how respectful, honest, and responsible you are

<u>CDP Part Two: Goal Revision/Brief Reflection</u>

Communication –

1. Reflect on/track your progress on your initial goals from CDP Part One
a. Have you intentionally worked on improving this competency based on your goals? Were you surprised by the formative feedback you received on your communication skills?
2. Revise those goals, and/or set new goals for this competency for the remainder of the semester
a. How else can you improve your skills in this competency? If you believe you've mastered one aspect of the competency, create a new goal for another aspect of the competency for the remainder of the semester. If you

have not achieved your goal(s) thus far, reflect on why, and then revise your goals to make them more achievable.

Teamwork –

1. Reflect on/track your progress on your initial goals from CDP Part One
    a. Have you intentionally worked on improving this competency based on your goals? Were you surprised by the formative feedback you received on your teamwork skills?
2. Revise those goals, and/or set new goals for this competency for the remainder of the semester
    a. How else can you improve your skills in this competency? If you believe you've mastered one aspect of the competency, create a new goal for another aspect of the competency for the remainder of the semester. If you have not achieved your goal(s) thus far, reflect on why, and then revise your goals to make them more achievable.

Professionalism –

1. Reflect on/track your progress on your initial goals from CDP Part One
    a. Have you intentionally worked on improving this competency based on your goals? Were you surprised by the formative feedback you received on your professionalism skills?
2. Revise those goals, and/or set new goals for this competency for the remainder of the semester
    a. How else can you improve your skills in this competency? If you believe you've mastered one aspect of the competency, create a new goal for another aspect of the competency for the remainder of the semester. If you have not achieved your goal(s) thus far, reflect on why, and then revise your goals to make them more achievable.

<u>CDP Part Three: Summative Reflection/Goals Moving Forward</u>

Communication –

1. Reflect on your progression in this competency throughout this semester.
    a. From where you started in August, to now, have you improved your skills? How do you know if you've improved your skills? Were you surprised by the formative feedback you received on your communication skills the second time around? What aspects of this competency do you feel you could still improve/need improvement on?
2. Make a plan for how you will continuously maintain/improve your skills in this competency as it relates to the medical field.

    a. How will you take what you've learned about your communication skills and move forward? How will you ensure you are consciously competent in this skill as you become a medical professional?

Teamwork –

1. Reflect on your progression in this competency throughout this semester.
    a. From where you started in August, to now, have you improved your skills? How do you know if you've improved your skills? Were you surprised by the formative feedback you received on your teamwork skills the second time around? What aspects of this competency do you feel you could still improve/need improvement on?
2. Make a plan for how you will continuously maintain/improve your skills in this competency as it relates to the medical field.
    a. How will you take what you've learned about your teamwork skills and move forward? How will you ensure you are consciously competent in this skill as you become a medical professional?

Professionalism –

1. Reflect on your progression in this competency throughout this semester.
    a. From where you started in August, to now, have you improved your skills? How do you know if you've improved your skills? Were you surprised by the formative feedback you received on your professionalism skills the second time around? What aspects of this competency do you feel you could still improve/need improvement on?
2. Make a plan for how you will continuously maintain/improve your skills in this competency as it relates to the medical field.
    a. How will you take what you've learned about your professionalism skills and move forward? How will you ensure you are consciously competent in this skill as you become a medical professional

APPENDIX F

Anatomy Team Charters (ATCs)

ANATOMY TEAM CHARTER (ATC)
(assigned after each team has had two labs)

Teamwork is an integral part of your future careers as physicians, as well as in the Gross Anatomy laboratory as first-year medical students. You will be with the same team of 3-4 individuals throughout the entire semester (~20 weeks), dissecting together at least once a week,and creating and adhering to an Anatomy Team Charter (ATC) together. A "team charter" is a document developed by all team members to outline team-specific goals and norms on tangible manifestations of professionalism and teamwork (e.g., attendance, tardiness, participation) (Dougherty et al., 2018). If you are familiar with the concept of a 'Roommate Agreement', that idea is comparable to a team charter. The overarching goal of implementing ATCs is to engage students in taking ownership for your own learning experience and concomitant development of non-traditional discipline-independent skills by developing custom created "team charters" to guide your team-based experience.

In developing your ATC, we have provided below a set of expectations, eight key principles, and
probing questions to help your team create and adhere to a set of guidelines throughout the
semester. It is to you and your teams' benefit to take this assignment seriously and to be as open
and honest with each other as possible in the creation of this agreement.

Expectations for your ATC (adapted from Dougherty et al., 2018):
- Understand that teams require both individual and mutual accountability
- Understand that teams rely on more than group discussion, debate, decision and on more than just sharing information and performance on formative feedback-based activities
- Understand that the team's performance and outcomes (e.g., completion of dissections) are achieved through the joint contributions of all their members
- Understand that the role of the assigned team leader is to facilitate team activities and direct the team in maximizing the talents of individuals within the team
- Understand that providing and receiving feedback for personal and team enhancement is a responsibility of every individual within the team.

Key Principles	Guidelines
Goals	What are the team's goals (academic performance, dissection time, lab reviews) and objectives?
	How will the team keep members motivated throughout each block?

	How will the team reward itself (and individual members) for a job well done?
Norms	How do we deal with inappropriate humor?
	How do we deal with a teammate who dominates, resists, is too quiet or noisy, etc.?
	How will we monitor our progress?
	What important roles need to be assumed by team members throughout the fall? How will these roles (dissection leader, dissection assistant, dissection transcriber/cleanup leader) be assigned? What do we do if an individual doesn't like their assigned role?
Decision Making	How do we make decisions?
	What decisions must be agreed to by all?
	What does consensus mean?
	Who will we ask when we get stuck (another team, TA, professor, first available)?
Participation	What do we mean by participation?
	How do we encourage equal participation?
	Are there group norms that we can establish to encourage participation?
Attendance	Who will be responsible when/if we do not complete a dissection to return and complete it?
	Since team meetings should start on time, how do we deal with lateness?
	What does "on time" mean?
	How often should we meet outside of lab?
	How do we address flat contributions?
Interruptions	How do we deal with interruptions? (e.g., phone calls that take you away from the team meeting/lab time)
Team Socializing	Who cleans up?
	How much socializing during lab time is permissible?
	How many breaks during lab time are permissible?
Conflict	How will the team encourage positive/creative conflict and discourage negative/dysfunctional conflict?
	How can the team encourage and manage differences of opinion and different perspectives?
	Has the team had any conflicts so far? If so, reflect on the situation and how the team moved forward/stayed stagnant and where to go from here.

ANATOMY TEAM CHARTER REVISION (Assigned mid-block 3)
You have now experienced roughly half of the semester dissecting with your teammates and
hopefully adhering to your ATC. Now it is time to meet outside of lab and revise your ATC

based on your experience of team interactions and usefulness (or uselessness) of your charter
thus far. You are encouraged to re-align your expectations for the remainder of the semester and
edit your charter as you see fit. (Insert expectations, key principles, and probing questions below.
For ease, allow them to edit/add to their original document rather than creating an entirely new
one)

CURRICULUM VITA

Emily M. Porta-Miller
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EDUCATION

PhD, Anatomical Sciences and Neurobiology Expected May 2024
MSc, Anatomical Sciences and Neurobiology August 2022
University of Louisville School of Medicine - Louisville, KY
Overall GPA: 3.855

BA, Biology April 2020
Bellarmine University - Louisville, KY
Overall GPA: 3.83

PROFESSIONAL AND TEACHING EXPERIENCE

Lab Instructor, Lecturer, Teaching Asst for Medical Gross Anatomy 07/2023-12/2023
University of Louisville School of Medicine - Louisville, KY

- Zone instructor for 27, 3-hour long Gross Anatomy labs consisting of whole-body anatomy.
- Created lecture materials for the Cubital Fossa, Forearm, and Upper Limb Joint anatomy. Conducted:
    - In-person lecture of Cubital Fossa and Forearm anatomy
    - Virtual pre-recorded lecture of Upper Limb Joint anatomy
- Assisted in creating, proctoring, and grading lab exams.

Teaching Assistant, Lab Instructor for Medical Gross Anatomy 08/2022-12/2022
University of Louisville School of Medicine - Louisville, KY

- Zone instructor for 10, 3-hour long Gross Anatomy labs consisting of upper limb, back, and lower limb anatomy.
- Assistant zone instructor for 22, 3-hour long Gross Anatomy labs consisting of thoracic cavity, abdominal cavity, pelvic cavity, and head/neck anatomy.
- Completed cadaveric dissections prior to upper limb, back, and lower limb lab instruction resulting in roughly 30 hours of self-instructed dissection experience using Grant's Dissector by Detton

- Executed Lower Limb Prosections that were photographed for the first-year medical students' Gross Anatomy Dissection Lab Manual.
    - Prosections included: anterior/medial thigh, posterior thigh and gluteal region, leg, and foot musculature and neurovasculature

Selected Participant, Anatomy Education Research Institute (AERI) 07/2022

Indiana University - Bloomington, IN

- Selected to be one of the 50 participants at AERI 2022.
- Workshops attended:
    - Designing your Educational Research Study; Human Subjects Research Considerations in Education Research;
    - Quantitative Research Methods; Qualitative Research for Anatomy Educators; Grounded Theory vs. Phenomenology;
    - Survey Design and Administration; Using Mixed Methods; The Ins and Outs of Meta-Analysis; etc.

Junior Teaching Assistant, Medical Gross Anatomy 08/2021-12/2021

University of Louisville School of Medicine - Louisville, KY

- Assisted instructing 32 Gross Anatomy labs consisting of upper limb and back, lower limb, thoracic cavity, abdominal cavity, pelvic cavity, and head/neck anatomy.
- Completed cadaveric dissections prior to lab instruction resulting in approximately 100 hours of self-instructed dissection experience using Grant's Dissector by Detton.

Teaching Assistant, Physician Assistant Gross Anatomy 07/2021-08/2021

University of Louisville/Sullivan University - Louisville, KY

- Taught multiple groups of 5-10 students upper limb joints, lower limb joints, and thorax regions on freshly prosected donors.
- Assisted Dr. Nicole Herring in instructing labs of the superficial and deep back and abdominal cavity.

First-Year Focus Student Instructor 08/2019-12/2019

Bellarmine University – Louisville, KY

- Co-taught BU-100, a required course for all first-time, full-time, traditional age students, with faculty member Mr. Josh Whitacre.
- Provided an extended orientation and facilitated students' transition to Bellarmine University.

Assistant Academic Director 07/2019
Georgetown University – Washington, D.C.

- Directed the 1-week Nursing Academy and 1-week Data Science Academy for two cohorts of 25 high school students.
- Led, implemented, and oversaw day-to-day logistics for the duration of the academies.
- Provided high level administrative and programmatic support to the Academic Director and executed special projects as assigned by program leadership.
- Supervised and supported the high school students and Program Assistants.
- Reviewed and approved timesheets for Program Assistants.
- Oversaw daily and event attendance records.
- Enforced University policies, procedures, and regulations to students and staff.

Medical and Science Program Assistant 06/2019-07/2019
Georgetown University – Washington, D.C.

- Responsible for supervising a cohort of 25 high school students throughout academic programming during the Summer Programs for High School Students 1-week Medical Academies.
- Led discussion sessions after designated program activities and events.
- Demonstrated venipuncture, endotracheal intubation, sterile gloving and gowning, and manual blood pressure in the Patient Simulation Lab.

Gross Anatomy Lab Assistant 06/2019-07/2019
Georgetown University – Washington, D.C.

- Taught multiple groups of 15-25 students the anatomy involved with endotracheal intubation on a bisected head, larynx, and frontal section of the head.

Gross Anatomy Workshop Assistant 06/07/2019
Northern Kentucky University – Highland Heights, KY

- Directed Cadaver Lab Workshops on Brain Anatomy for the University of Kentucky Medical School Early Assurance Program students at the Northern Kentucky University campus.

Administrative Student Program Coordinator 05/2019-05/2020
Bellarmine University – Louisville, KY

- Supervised, observed, and evaluated 11 tutors in the Tutoring Cente
- Facilitated staff training at the beginning of each semester.
- Served as the point of contact for hiring new tutors, which included: conducting interviews, filling out new-hire paperwork, and holding orientation for new hires.

- Tracked tutor timesheet data, maintained accurate mailbox labels and name tags, kept an inventory of office supplies, tracked course coverage, and maintained up-to-date staff rosters.

Student Success Center Tutor 08/2017-05/2020

Bellarmine University – Louisville, KY

- Tutored Principles of Biology (Biol-130), Animal Diversity (Biol-140), Plant Diversity (Biol-220), Cell Biology (Biol-231), and Understanding Environmental Systems (ENVS-151).
- Assisted students with test preparation, provided content clarification, and offered guidance in study skills.
- Completed CRLA level 1 and level 2 tutor training.

Chair, Student Success Leadership Board 04/2018-05/2019

Bellarmine University – Louisville, KY

Communications/Social Media/Promotions Chair

- Provided opportunities for academic, professional, and social growth for Student Success Center student-staff.
- Planned Professional Development events for all students.
- Connected students to campus resources. Advocated for peers to University leadership.

RESEARCH

Doctoral Work

PhD Research Proposal Defense Presentation. 06/30/2023. A Mixed Methods Investigation of Competency Development in the Medical Anatomy Laboratory. Unanimously passed the defense.

Qualifying Examination. 07/18/2022-08/01/2022. Integrated graduate course material, demonstrated critical thinking, and evaluated the literature related to competency-based medical education in the gross anatomy lab context to complete an extensive written qualifying exam. Passed with no revisions, resulting in PhD Candidacy and a Master of Science in Anatomical Sciences and Neurobiology.

Conference Presentations

American Association of Clinical Anatomists (AACA)

- Porta, Emily M. and Jennifer Brueckner-Collins. 2023. Medical Students' Self-Assessments of Competencies in the Gross Anatomy Laboratory Context. Poster presentation on 07/11/2023 at the 2023 AACA Conference in Orlando, FL.
- Porta, Emily M. and Jennifer Brueckner-Collins. 2022. Taking a Competency Based Approach to Gross Anatomy Laboratory Instruction: A Pilot Study. Poster presentation on 06/15/22 at the 2022 AACA Conference in Fort Worth, Texas.

- Porta, Emily M., Nicole Herring, and Jennifer Brueckner-Collins. 2021. Using Yammer™ to Build Community in a Virtual Anatomy Curriculum for First-Year Medical Students. E-Poster presentation at the 2021 AACA Virtual Conference.
- Porta, Emily M. and David J. Porta. 2020. Can Anatomical Structures on a Bisected Cadaver Donor Head Indicate a History of OSA? E-Poster presentation at the 2020 AACA Virtual Conference.

Research!Louisville/Student Research Day at Bellarmine University

- Porta, Emily M., and Jennifer Brueckner-Collins. 2023. A Mixed-Methods Study Investigating First-Year Medical Students' Communication Competency Development in the Gross Anatomy Lab Context. Poster presentation at Research!Louisville on 10/3/2023.
- Johnson, Megan; Porta, Emily; Brueckner-Collins, Jennifer; Davis, Brian. 2023. Visual Arts in Medical Education: 3D-Printed Anatomic Model of the Pelvis and Perineum. Poster presented by Johnson at Research!Louisville on 10/3/2023.
- Porta, Emily M., Nicole Herring, and Jennifer Brueckner-Collins. 2021. Using the Social Network Tool Yammer™ to Provide Academic Support for Preclinical Medical Students During Pandemic Instruction. Poster presentation at Research!Louisville on 10/26/2021.
    - Porta, Emily and David J. Porta. 2020. Can Anatomical Structures on a Bisected Cadaver Donor Head Indicate a History of OSA? Abstract presented during online Student Research Day at Bellarmine University on 4/14/20.

Publications

- Porta, Emily M. and Jennifer Brueckner-Collins. 2023. Medical Students' Self-Assessments of Competencies in the Gross Anatomy Laboratory Context. Abstract accepted 04/12/23 for publication in *Clinical Anatomy*.
- Porta, Emily M. and Jennifer Brueckner-Collins. 2022. Taking a Competency Based Approach to Gross Anatomy Laboratory Instruction: A Pilot Study. Abstract accepted 4/5/22 for publication in *Clinical Anatomy.*
- Porta, Emily M. and David J. Porta. 2020. Can Anatomical Structures on a Bisected Cadaver Donor Head Indicate a History of OSA? Abstract accepted 4/23/20 for publication in *Clinical Anatomy*. https://doi.org/10.1002/ca.23694

Podcasts

- Rabalais, G., Saner, S., Weingartner, L. (Hosts). (2023, September 29). Bringing Competency-Based Medical Education (CBME) into the Basic Science Curriculum at the School of Medicine with Jennifer-Brueckner-Collins and Emily Porta (No. 98) [Audio podcast episode]. In Faculty Feed. HSC Office of Faculty Development, University of Louisville. https://podcasters.spotify.com/pod/show/hscfacdev/episodes/Bringing-Competency-Based-Medical-Education-CBME-into-the-Basic-Science-Curriculum-at-the-SOM-with-Jennifer-Brueckner-Collins--Emily-Porta-e28bsm6/a-aa8t7kr

AWARDS AND CERTIFICATIONS

University of Louisville

- Recipient, Dissertation Completion Award for Spring 2024 — 01/2024-05/2024
- Winner, Professional & Educational Development Award at Research!Louisville — 10/2023
- Recipient, Robert Acland Fellowship for Anatomy Educatio — 07/2022-12/2023
- Recipient, Graduate Student Council Travel Award — 09/2022
- Integrated Programs in Biomedical Sciences (IPIBS) Fellowship — 08/2020-06/2022
- CITI Program Certifications:
  - Human Research — Expires 01/2025
    Human Subjects and HIPAA Research.

Bellarmine University

- Magna Cum Laude Honors — April 2020
- Nominee, *In Veritatis Amore* Award — April 2020
- Recipient, Monsignor Horrigan Scholarship — May 2016
- Dean's List: SP 2017, SU 2017, FA 2017, SP 2018, FA 2018, SP 2019, FA 2019, SP 2020

SERVICE AND LEADERSHIP

- Member of Neurobiology and Anatomical Sciences Student Association at the University of Louisville School of Medicine — 09/2022-Current
- Graduate Student Representative on the University of Louisville School of Medicine Graduate Council — 07/2021-Current
- Member of American Association for Anatomy (AAA) — 04/2021-Current
- Member of American Association of Clinical Anatomists (AACA) — 03/2020-Current
- Vice President of Leading Women of Tomorrow Student Organization at Bellarmine University — 01/2019-05/2020
- Vice President and Treasurer of the Women's Club Volleyball Program at Bellarmine University — 05/2018-05/2020