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Academic Self-Concept and Master Adaptive Learning in First Year Medical Students: A Validation and Scale Construction Study

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University.

by

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Abstract

ACADEMIC SELF-CONCEPT AND MASTER ADAPTIVE LEARNING IN FIRST YEAR MEDICAL STUDENTS: A VALIDATION AND SCALE CONSTRUCTION STUDY

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Students' academic self-concepts (ASC) and their orientation towards self-regulated learning are important elements of success. Despite this fact, little work has been conducted exploring these areas medical students. Given the shifting priorities of medical education toward competency-based education and self-directed learning, the goals of this study were to validate an existing measure of ASC and to improve our measurement capabilities for understanding the Master Adaptive Learner (MAL). Evidence for validity and scale reliability was collected for the ASCS with this novel population and a range of motivational and self-regulative variables (Goal

orientation, academic emotion regulation, and lifelong learning) were analyzed and reduced to produce a single scale for MAL. Surveys were administered to 203 medical students at an urban, Mid-Atlantic medical school and students' grades were linked to survey responses. Results of a confirmatory factor analysis indicated that the original factor structure was not a good fit to the data for the current data. An exploratory factor analysis (EFA) was conducted to identify which structure fit better, and while a three-factor structure was produced, only one factor met reliability standards. This factor, confidence, was merged with items from the other surveys, and reliability scores for a composite MAL scale were identified. Based on these findings and the result of an EFA, the total item pool was reduced from 83 to 25. These 25 items discriminated between two clusters of students: MALs and others. Students' membership in the MAL cluster predicted greater performance on the first exam in medical school, but not on any other grade outcomes. These results provide early evidence for the continued study of MAL and motivation in medical school, which will help researchers and curriculum designers support the development of future physicians.

Chapter One
Introduction

Everyone approaches their physician with expectations of high-quality care and expertise. While all practicing physicians develop these skills through the course of their training, they begin as novices and students; through formal and practical education, they develop into the experts we see and interact with. However, when it comes to the stakes that arise when individuals interact with physicians in a care context, it can be challenging from the patient perspective to grasp that the person providing care may not have all the answers; patients have a range of expectations for their physicians (e.g., Sabbatini et al., 2014; Regis, Steiner, Ford, & Byerley, 2011) that may or may not align with the skills or knowledge held by that physician for that care context. These expectations paint a picture of a physician who demonstrates competence in a wide range of areas and has learned specific skills over their career to balance patient needs and medical outcomes.

If we flip the script and consider this interaction from the perspective of the physician, we see someone who recognizes the stakes of their practice but may not have all the answers. These individuals may need to go out and find the information necessary to make the best decision. Practicing physicians, residents in training, and medical students alike must be able to seek out and apply new information. In short, when it comes to their career, physicians should not cease to be students of their field.

This poses a problem for medical education. Medical school curricula must prepare students with core medical knowledge and clinical skills, but also the ability and drive to become lifelong learners and critical consumers of information capable of solving problems in practice. Because of the intense focus on patient care, medical school can sometimes seem outside of typical educational structures; given the lengthy continuum of training and the connection between education and clinical practice, medical education is different in some ways than education in other contexts. In K-12, university, or professional contexts, understanding the perspectives and skills that students bring with them are important elements to promoting student success (e.g., Schmidt et al., 2017; Marsh et al., 2016; Green et al., 2012). When it comes to learners in the medical context, however, it seems little research exploring their perceived as students is available.

We know the kinds of students we want to train. Accrediting bodies provide competencies that students should possess, such as professionalism or medical knowledge (e.g., LCME, 2017). In turn, these competencies shape instruction (Rider, Nawotniak, & Smith, 2007). At the same time, research calls for the creation of master adaptive learners (MAL): individuals capable of metacognitive reflection and self-regulated learning in the healthcare environment (Cutrer et al., 2017). It is therefore essential to understand medical students and their development as learners because it is on their journey through medical education that all these desired outcomes rest. If we want to create physicians who embrace these competencies as lifelong learners, it is first necessary to understand medical students' earliest experiences in their field. These experiences lay the groundwork for motivational development across the continuum.

Statement of the Problem

Students have differing perceptions of their academic abilities. Academic self-concept (ASC) refers to an individual's perceptions of competence in academics (Shavelson, Hubner, & Stanton, 1976). ASC has been studied for decades as an indicator of student motivation and positive academic outcomes. High-achieving students also struggle in high-performance environments because of the interplay between expectations and social comparisons (Marsh & Parker, 1984). Few educational environments are as high achievement—or high pressure—as medical school, and student stress comes with this territory (e.g., Lee & Graham, 2001; Voltmer, Ktter, & Spahn, 2012; Tyssen et al., 2007). While the body of research on ASC is robust, the subset focusing on the ASC of medical students is small and largely from international contexts (e.g., Jackman, Wilson, Seaton, & Craven, 2011; Yeung, Li, Wilson, & Craven, 2014). Given the pressures of the learning and clinical environments (e.g., O'Brien, Cooke, Irby, 2007) and the fact that competency-based education (CBE) may be a new educational approach for many students, it is important to understand how medical students perceive their academic competence. These perceptions are one important element on the road to becoming a good doctor and maintaining clinical competence (Cruess, Cruess, Boudreau, Snell, Steinert, 2015). ASC affords one potential lens to explore this development, as students' perceptions of academic competence lay the foundation for their future success in medical school and clinical practice.

Students' perceptions of their competence are related to success in other contexts (e.g., Schmidt et al., 2017; Marsh et al., 2016; Green et al., 2012); more fully understanding medical students' perceptions of their academic competence helps us to better understand how students function in the current CBE climate in medicine. In the medical education context, Frank and colleagues (2010) highlight four core elements of CBE: 1) a focus on curricular outcomes, 2) an

emphasis on abilities, 3) a de-emphasis on time-based training, and 4) the promotion of learner-centeredness. Morcke and colleagues suggest that the "adoption of OBE [CBE] would better equip medical graduates to respond effectively in complex situations and efficiently continue to expand the depth and breadth of the requisite competencies" (2010, p. 854). When we look at ASC literature, these competency beliefs predict the academic success of students outside of medicine; students' experiences of competency drive future competence, motivation, and success (e.g., Arens, Yeung, Craven, & Hasselhorn, 2011; Wigfield & Karpathian, 1991). This is a meaningful connection, but if ASC cannot be linked to core competencies of the field, the value of that connection is limited. A key first step in building this linkage is to consider what competencies are valued in medical education.

To ensure high-quality medical education, the Liaison Committee on Medical Education (LCME) outlines twelve standards for the accreditation of medical schools (LCME, 2017). In its relationship to ASC, Standard Six (Competencies, Curricular Objectives, and Curricular Design) is an area of key focus. This standard states that individual medical schools define goals and competencies that graduating students should meet, and lists several required elements including clinical experiences, opportunities for elective work, and a focus on self-directed and lifelong learning (LCME, 2017). Given initiatives to produce master adaptive learners who also engage in lifelong learning and are equipped with deep, practical medical knowledge, understanding students' growth is important. Despite the value placed on academics and continual learning, no specific tool is included that captures medical students' perceived competence in the academic domains of their training, nor their status as a MAL. Building on prior work in this space, ASC is a promising construct that may provide information about perceived competence in medical education settings. In conjunction with other constructs, ASC may also provide insight into the

presentation of MAL in medical students. Together, MAL and ASC will strengthen our understanding of students and the trajectories of their development.

Brief Literature Review

Medical education. Medical education is a complex and dynamic field shaped by contemporary social and political landscapes. Curriculum offices are tasked with providing support for learners' needs as medical students while also preparing them as future physicians; at the same time, the curriculum must balance providing basic science education and the training for clinical skills. To further complicate matters, we must consider that the environments that we are sending students and doctors into are changing as well. Social and political changes, such as healthcare policy at the national level, can influence a physician's day-to-day practice (Hanney, Greenhalgh, Blatch-Jones, Glover, & Raftery, 2017), and no two patients will be exactly alike. If doctors must be able to respond to a range of needs, then a clear picture of their learning is important.

Giving attention to differences between students and their self-direction is a recent trend in the history of medical education. For almost 100 years, medical education has followed largely the same pattern outlined by the Flexner Report (Flexner, 1972), a Carnegie Foundation funded evaluation of the medical schools in the United States and Canada. Much of the structure of modern medical education still comes from this report, including the standard division of clinical and preclinical coursework and the focus on concrete grading criteria for admissions and advancement. However, modern shifts towards competence and entrustment have begun to drive curricular design away from more classical structures. In a 2010 follow-up, Cooke and colleagues suggest that medical education in the United States is at a crossroads: "those who teach medical students and residents must choose whether to continue in the direction established

more than a hundred years ago or take a fundamentally different course, guided by contemporary innovation and new understanding about how people learn" (p.1).

To address these changing needs for medical education, in 2013, the medical school around which this dissertation study is centered (referred to moving forward as Atlantic Medical School; AMS), launched a new curricular model (Figure 1). This new curriculum operates under three tenets. The curriculum is 1) centered on the needs of the learner, 2) clinically driven, and 3) competency-based. The curriculum aims to address the needs of the learner as they relate to the development of medical professionals—including preparing them to work on teams and handle dynamic environments—to provide as much clinical experience as possible. It also aims to produce physicians who demonstrate competence across the core values of the profession as defined by the Accreditation Council for Graduate Medical Education (ACGME). Objectives were identified and defined for the curriculum per LCME requirements that align closely with the six core ACGME competencies. This focus aims to produce students capable of demonstrating competence in the same areas they will be expected to as practicing physicians. Part of the work establishing this new curriculum as an effective educational model entails building a deeper understanding of students' experience, resulting in a range of data exploring student performance and functioning.

Academic self-concept. Self-concept represents an individual's perceptions of him/herself that is shaped by experiences within a given environment (Shavelson et al., 1976). The work of Shavelson, Hubner, & Stanton (1976) was important for the construct because it brought together the existing body of literature and presented a more unified understanding of self-concept.

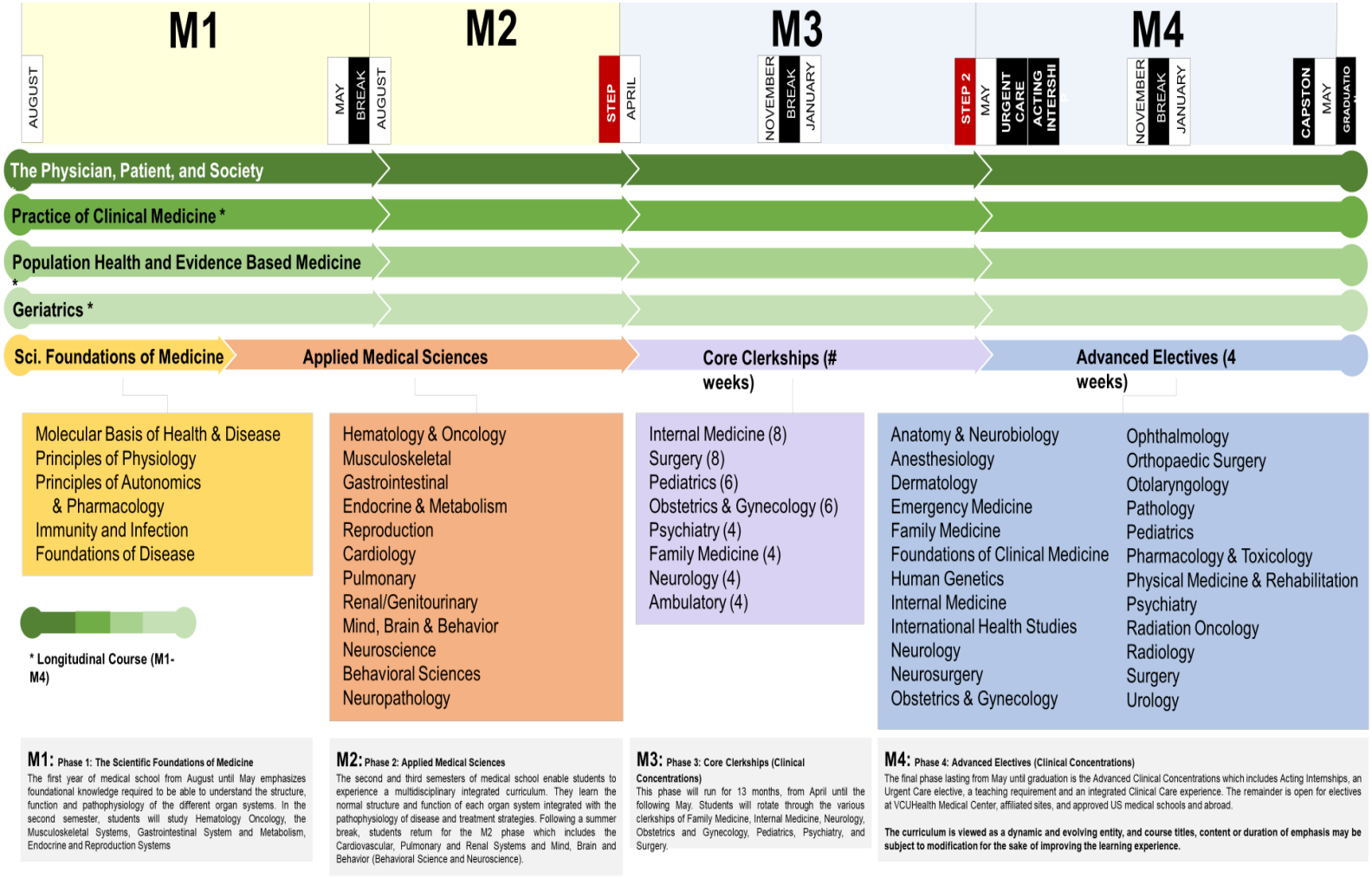

Figure 1. Outline of the AMS C3 Curriculum model.

This unified understanding included key features of self-concept: "(a) organized, (b) multifaceted, (c) hierarchical, (d) stable (general self-concept)/unstable (situational), (e) developmental, (f) descriptive and evaluative, and (g) differentiable from other constructs" (Shavelson, et al., 1976, p. 435). Of interest for the present research is the characterization of self-concept as multifaceted: One of the most significant facets relates to academics, such that early conceptualizations were divided as academic and non-academic self-concepts. Academic self-concept represents students' academic self-perceptions (Marsh, 1990), but just as self-concept is multifaceted, so too is academic self-concept. Key components of students' academic self-concepts include mathematical self-concept and verbal self-concept (Marsh, Byrne, & Shavelson, 1988). Students' academic self-concepts are complicated, and merit continued research. By understanding not only the content but also the process through which students build these self-perceptions, research can help to shape students' experiences in ways that are beneficial for both the student and future research.

A positive academic self-concept is related to positive educational outcomes. Self-concept, motivation, and behavior are all closely related (Wigfield & Karpathian, 1991). Academic self-concept can also be related to affect and further competence (Arens, Yeung, Craven, & Hasselhorn, 2011). The relationship between academic self-concept and achievement is most widely studied; prior achievement is a significant predictor of subsequent academic self-concept (Marsh & Yeung, 1997). Research also suggests a reciprocal relationship between ASC and achievement (Seaton, Parker, Marsh, Craven, & Yeung, 2014). Taken together, these studies help to illustrate the value of academic self-concept in the lives of students, but also why it is an important area of study. As described above, students' beliefs about their competence are related to key outcomes that are hallmarks of positive school experiences. If we understand how these

factors are related to both self-concept and the environment in which students learn, then we can better understand how to make environments that are more sensitive to students' needs and desires for their own education. ASC is not just related to students' achievement, though, and can be related to the same constructs we look for in master adaptive learners, such as self-regulation (Ommundsen, Haugen, & Lund, 2005), achievement goal orientation (Albert & Dahling, 2016), and lifelong learning (Fryer, 2015)

A key factor of students' environments in the K-12 context is their interactions with others. Social contexts play an important role when it comes to self-concept. Academic self-perceptions like competence are predicted by classroom climate dimensions (Kokkinos & Hatzinikolaou, 2011); students who exhibit low levels of acceptance by their peers are likely to demonstrate less positive academic self-concepts (Flook, Repetti, & Ullman, 2005). The teacher/student relationship has also been "identified as a mediator in the association between students' individual school self-concept and their school engagement, school belonging and their feelings of helplessness in school" (Raufelder, Sahabandu, Martínez, & Escobar, 2013, p. 15). It is clear, then, that students do not construct academic self-concept in isolation. They take meaning and information from those around them to inform how they see themselves. Given the high achievement context of medical school, the social construction of competence is likely to extend past K-12 schooling and into more advanced students.

Purpose of Study

The purpose of this study is two-fold: 1) to further our understanding of medical student learning by providing validity evidence for the ASCs of medical students, and 2) to improve our measurement capabilities in understanding the MAL. While ASC has been extensively studied, work involving medical students is sparse. Given this lack of information, validating an

instrument for capturing ASC first-year medical students is important to understand medical students and ASC. Given the difficulty and challenges experienced by medical students during their education, establishing measurement validity will allow future studies to explore the change in these beliefs over time. At the same time, by linking ASC with other motivational constructs, this study also produced a reduced MAL scale for use in medical education. Research in other contexts suggests the importance of motivation and self-regulation for student success, and the frameworks outlined by White and Gruppen (2010) and Cutrer and colleagues (2017) provide a meaningful starting place, but without a single tool for capturing the construct, the practical utility of those frameworks is limited. Together, the two goals of this study will expand our understanding of medical students and their learning to better train future physicians.

Definition of Terms

Academic emotion regulation. The process through which individuals recognize, monitor, evaluate, and modify their emotional reactions in academic settings (Burić, Sorić, & Penezić, 2016).

Academic self-concept. Students' academic self-perceptions (Marsh, 1990) and knowledge about self, relating to achievement settings and their perceived competence for completing academic tasks.

Goal orientation. An individual's motivational framework for responding to and interpreting tasks and situations, often relating to competence development or demonstration. (VandeWalle, 1997).

Lifelong learning. "A concept that involves a set of self-initiated activities and information seeking skills that are activated in individuals with a sustained motivation to learn and the ability to recognize their own learning needs" (Hojat et al., 2003).

Master adaptive learning. Metacognitive, reflective, and self-regulated learning in the healthcare environment, where learners plan, learn, assess, and adjust their learning and practice based on experience (Cutrer et al., 2017).

Self-concept. Self-concept is a "person's perception of himself" (Shavelson, et al., 1976, p. 411). Often relating to competence beliefs, global self-concept can be broken down into more specific sub-components (e.g., academic, physical, interpersonal).

Chapter Two
Review of Literature

The purpose of the current study is to expand the theoretical understanding of medical students' learning in the areas of academic self-concept (ASC) and master adaptive learning (MAL). To do so, this review of literature presents not only information on academic self-concept but on the context of historical and modern trends in medical education. While the goal of medical education is to produce the best doctors possible, changes in the educational context and what is valued inform how we see that outcome. These changing contexts set the stage for a broader consideration of learners' beliefs, such as their perceived competence in academics. Understanding these beliefs is valuable when it comes to the education of medical students, and in modern CBE environments, it is also valuable when it comes to making good doctors. To this end this study addresses two main research questions:

1. Does the Academic Self Concept Scale provide valid information about the ASCs of first-year medical students?
2. Do existing tools linked to conceptualizations of MALs form distinct factors and predict student performance differently?

Driven by these questions, this study validates a measure of ASC for use with the medical student population and develops an early version of a single tool for the evaluation of MAL.

Before exploring the two main facets of this study (medical education and ASC) it is important to ground both the study and this literature review in a broad theoretical framework. In

this case, with the personal and behavioral elements represented by MAL and ASC along with the environmental elements captured by the medical school experience, it makes sense to rely on a theory that links these factors together. Bandura's (1986) social cognitive theory (SCT) fills this unifying need well; a core tenet of SCT is reciprocal determinism: the idea that behavior, cognition, and an individual's environment produce effects on each other (Bandura, 1978). For example: a students' self-efficacy beliefs may shape their choice of academic behaviors, while at the same time their environment may also impact what behaviors are available. Determinism here is meant to represent the effect produced by these forces and not to suggest that individuals are at the mercy of these forces: individual agency is actually an important element of SCT. Bandura identifies four key elements of agency in the SCT context (2001):

- Intentionality
- Forethought
- Self-reactiveness
- Self-reflectiveness

These agentic elements, as well as the interactive elements of reciprocal determinism, provide a framework for understanding the motivation of medical students. This study will provide additional information about ASC and MAL as they interact in the understudied context of medical education.

Medical Education

For almost 100 years, curricula have followed the pattern outlined by a Carnegie Foundation-funded study titled *Medical Education in the United States and Canada* (originally conducted and published in 1910 and commonly referred to as the Flexner Report; Flexner, 1972): two years of preclinical coursework and two years of clinical work. Recently, there have

been shifts in curricula that aim to provide students with a greater level of integration between the clinical and scientific elements of medical education. A 2010 follow-up to the Flexner Report calls for a shift to CBE to address patient safety concerns arising from a lack of clearly defined expectations of medical students and medical education (Cooke et al., 2010). These recommendations illustrate the value placed on the clinical competence of physicians and the role of medical education in helping produce competent physicians.

Modern shifts towards competence and entrustment have begun to drive curricular design away from more classical structures. Modern complexities in the education of physicians are "creating what some call an ongoing 'knowledge and skills gap' between what people know at one moment and what they will need to know at the next moment to be successful in their everyday lives and the workplace" (Cutrer et al., 2017). This gap places students' ability to adapt to novel situations and continually develop their competencies through medical school and into their careers at the forefront of medical education. Current goals in medical education center around building these competencies to encourage MAL (Cutrer et al., 2017), enhance professionalism (Irby & Hamstra, 2016), and build trust in the capabilities of graduating medical students (Chen, Van den Broek, & Ten Cate, 2015). Cooke and colleagues (2010) are clearly on the side of taking the new path and suggest four core recommendations for medical education programs interested in reform:

- Standardized learning outcomes with learning processes tailored to individuals
- Deeper integration between the knowledge and clinical experience elements of training
- Focus on promoting inquiry and improvement
- Explicit address of professional identity formation

These recommendations draw a picture of medical education that is student-centered and concerned with the improvement of learners.

Master Adaptive Learning. Self-regulated learning (SRL) is not a new concept, but its application towards medical education is more novel. Beginning with a treatment of SRL in medical students, White and Gruppen (2010) condense research and models for SRL into four key phases: planning, learning, feedback, and adjustment; these phases include constructs such as self-efficacy, self-assessment, and attribution (White & Gruppen, 2010; See Table 1). This work was then extended by Cutrer and colleagues (2017) to highlight specific behaviors within each phase such as selecting learning opportunities, testing learning, and incorporating learning into practice. Also important in this model is an increased focus on the relationships between MAL phases (Figure 2). As healthcare changes and the training of medical students changes with it, finding ways to teach these skills to learners will be a valuable way to ensure future development. However, while the theoretical framework of MAL has been described, no single measure exists to explain its theoretical workings. While White and Gruppen (2010) outline constructs contained under the umbrella of MAL, there is a practical need for a condensed instrument that can capture MAL information for curriculum planners while not adding additional burden to students who are already frequently surveyed (Porter, Whitcomb, & Weitzer, 2004).

Table 1

Self-Regulated Learning: Phases and Elements

Phase	Element
1. Planning	Goal setting
	Self-efficacy
2. Learning	Epistemology
	Learning strategies
	Principles and methods
3. Assessment	Self-monitoring
	Self-assessment
	External feedback
4. Adjustment	Reflection
	Attribution

Note. Adapted from "Self-Regulated Learning in Medical Education" by C.B. White and L.D. Gruppen, 2010, *Understanding Medical Education: Evidence, Theory and Practice,* p. 272. 2010 by "Wiley-Blackwell".

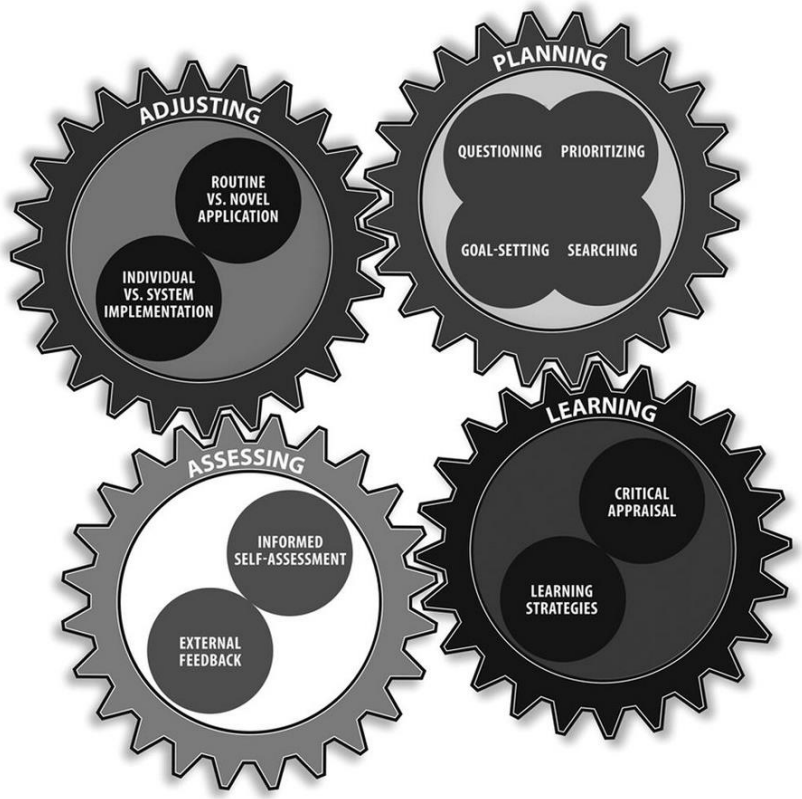

Figure 2. Cutrer and colleagues' (2017) Master Adaptive Learner Framework.
Note. Adapted from "Fostering the Development of Master Adaptive Learners: A Conceptual Model to Guide Skill Acquisition in Medical Education" by W.B. Cutrer et al., 2017, *Academic Medicine, 92*(1), 70-75.

Physician competence. It is worth noting that MAL is just one conceptualization of physician competence. The Liaison Committee on Medical Education (LCME) outlines twelve standards for the accreditation of medical schools:

1. Mission, Planning, Organization, and Integrity
2. Leadership and Administration
3. Academic Learning Environments
4. Faculty Preparation, Productivity, Participation, and Policies
5. Educational Resources and Infrastructure
6. Competencies, Curricular Objectives, and Curricular Design
7. Curricular Content
8. Curricular Management, Evaluation, and Enhancement
9. Teaching, Supervision, Assessment, and Student and Patient Safety
10. Medical Student Selection, Assignment, and Progress
11. Medical Student Academic Support, Career Advising, and Educational Records
12. Medical Student Health Services, Personal Counseling, and Financial Aid Services

These standards are used to guide medical school functioning, curricular development, and student preparation in a modern landscape of redefining medical education. Ultimately, these standards lay out one preliminary framework for understanding physician competence; a student graduating from an accredited program will demonstrate certain competencies.

While these requirements pertain to medical students, there are similar competencies outlined for resident physicians. Six core competencies have been established by the Accreditation Council for Graduate Medical Education (ACGME), which serve as one way to consider what a good doctor might be (Swing, 2007):

- Practice-Based Learning and Improvement.
- Patient Care and Procedural Skills.
- Systems-Based Practice.
- Medical Knowledge.
- Interpersonal and Communication Skills.
- Professionalism

These competencies represent areas that medical students should develop to be successful in residency, but also areas for continual development along the path to practice. Some medical schools use these competencies as a framework on which to establish their curricula; for example: the medical school on which this study is focused has a one-to-one relationship between its objectives and the ACGME competencies (Table 2), so that students' medical education is directly related to the skills they are expected to have upon graduation. These competencies represent a longitudinal track for physician development: LCME standards call for CBE and lifelong learning which are taken by schools and developed into specific competencies (such as Self-Directed Learning and Self-Assessment or Putting Care in Practical Context), which then map onto expectancies for the next step of professional development. These expectations extend past learners' residencies and are monitored in practice by the Accreditation Council for Continuing Medical Education. These developing competencies are core to the medical profession, and measurement is necessary to best support them.

Table 2

Relationship Between Medical School Objectives and ACGME Core Competencies

Medical School Objective	ACGME Competency
1. Professionalism	Professionalism
2. Patient Engagement & Communication	Interpersonal & Communication Skills
3. Application of Scientific Knowledge & Method	Medical Knowledge
4. Patient Care	Patient Care
5. Putting Care in Practical Context	Systems-based Practice
6. Self-directed Learning & Self-Assessment	Practice-based Learning & Improvement

Other conceptualizations suggest that a competent physician is one who can teach others well (Santos, Alves, & Simões, 2017), while a survey of medical students suggests that students view communication and interpersonal interaction as more important than raw medical knowledge when it comes to physician competency (Sehiralti, Akpinar, & Ersoy, 2010). The value in MAL, however, is that it can be understood early in a physician's career—as early as medical school. By connecting the motivational and behavioral elements of MAL to students' development, it may be possible to better understand and shape their learning to produce highly competent physicians in the future.

Given these differences in understanding and historical perspectives in medical education moving towards competency as a driving principle, an early step in building this connection between broad competencies and students' academic beliefs is to validate a measure of ASC for medical students learning under a CBE framework. Many more questions exist, but a valid measurement base is necessary to address them. ASC and MAL may not answer all the questions we have about medical students or CBE, but it may provide a new lens through which we may examine these questions. As a measure of perceived competence, ASC fits well into this

framework, especially given that we want to establish lifelong learning and mastery-oriented competencies. Understanding this about students from day one lets us design curricula and interventions to better support student development, but only if ASC is valid for this population. At the same time, given trends toward self-directed and lifelong learning encapsulated in MAL, the lack of a single measure to capture this construct is significant.

Academic Self-Concept

Structure of academic self-concept. At the highest level, ASC represents an individual's knowledge and perceptions about themselves in achievement situations (Wigfield & Karpathian, 1991). These beliefs represent an understanding based on past experiences that inform individuals' broad domain judgments. At this point in the discussion, it is worth noting that this description can sound like self-efficacy (Bandura, 1997), but while similarities exist, ASC and academic self-efficacy are distinct constructs. Bong and Skaalvik (2003) take a comparative approach to the two constructs that help clarify the differences. The authors suggest that ASC is a broad, stable set of knowledge and perceptions related to perceived competence that is past-oriented, while academic self-efficacy is a more malleable series of beliefs about the successful completion of future tasks (Bong & Skaalvik, 2003). Other differences exist (and can be found in Table 3), but these broad definitions provide clarity and the rationale for the selection of ASC as the focus of this study. Students' previous experiences and their beliefs about their competence for completing general academic tasks are the core of this study as they relate to CBE and recent changes in medical education. In the agentic framework of SCT, ASC gives more power to the individual as their reflections on past academic success will inform task motivation and selection through self-reflection.

Table 3

Comparison Between Academic Self-Concept and Academic Self-Efficacy

Comparison Dimensions	Academic Self-Concept	Academic Self-Efficacy
1. Working definition	Knowledge and perceptions about oneself in achievement situations	Convictions for successfully performing given academic tasks at designated levels
2. Central element	Perceived competence	Perceived confidence
3. Composition	Cognitive and affective appraisal of self	Cognitive appraisal of self
4. Nature of competence evaluation	Normative and ipsative	Goal-referenced and normative
5. Judgement specificity	Domain-specific	Domain-specific and context-specific
6. Dimensionality	Multidimensional	Multidimensional
7. Structure	Hierarchical	Loosely hierarchical
8. Time orientation	Past-oriented	Future-oriented
9. Temporal stability	Stable	Malleable
10. Predictive outcomes	Motivation, emotion, and performance	Motivation, emotion, cognitive and self-regulatory processes, and performance

Note. Adapted from "Academic Self-Concept and Self-Efficacy: How Different Are They Really?" by M. Bong and E.M. Skaalvik, 2003, *Educational Psychology Review, 15,* p. 10. 2003 by "Springer".

Elements of ASC are also related to affect (Arens et al., 2011). Affect, an individual's emotional response, is an important factor to ASC: students who have more positive emotional responses to academic domains and tasks are more likely to have more positive self-concepts for those areas. These lines between competence and achievement also demonstrate why self-concept and self-efficacy can be easily confused, but the future-oriented nature of self-efficacy is a key distinguisher (Bong & Skaalvik, 2003). While self-efficacy pertains to beliefs about future success (or lack thereof), ASC is past-oriented and captures beliefs about situations as they have

been. Self-efficacy can be a key precursor to self-concept, as the experiences that build self-efficacy become more stable over time, promoting further experiences which will lead to increased competence. As students feel more favorable about their competence, ASC will improve.

Relationships with academic self-concept. One of the reasons that studying ASC is of such value is that it has been tied to a wide range of outcomes. A longitudinal study of Australian high school students found that when taken together, academic motivation and ASC were key elements that predicted attitudes towards school; emotional, cognitive, and behavioral engagement; and test performance (Green et al., 2012). Additional longitudinal work suggests that ASC, self-esteem, and academic achievement possess reciprocal relationships, but that when students work in more merit-based environments, self-concept is more likely to predict self-esteem (Trautwein, Ludtke, Koller, & Baumert, 2006). Wigfield and Karpathian (1991) draw extensive connections between self-concept, motivation, and behavior, suggesting that a positive self-concept is likely to support positive motivation, which is often followed by positive academic outcomes. These connections to motivation are important when seen in the context of competence development in medical education.

The relationship between academic self-concept and academic achievement is the most widely studied. Prior achievement is a significant predictor of subsequent academic self-concept (Marsh & Yeung, 1997); this makes sense conceptually given the role played by competence in ASC. Academic success serves as a mastery experience that helps students to feel more efficacious about future academic pursuits. Research also suggests a reciprocal relationship between the two constructs—for example, Guay and colleagues (2003) examined the relationship between achievement and ASC as a developmental relationship. While there was no evidence to

suggest that the relationship between achievement and ASC changed with age, older students described their ASC in ways that were more reliable, stable, and connected to their achievement (Guay, Marsh, & Boivin, 2003). In addition to providing further support for the reciprocal relationship between achievement and ASC, Seaton and colleagues (2014) were also able to demonstrate more positive correlations between mastery goal orientations and ASC than performance goal orientations and ASC.

Relationships also exist between ASC and other concepts related to adaptive learning. Self-regulation is a set self-directed processes and beliefs that allow learners to transform mental ability into performance (Zimmerman, 2008). Most often, self-regulation is thought of in terms of strategies that learners use in their environments, such as emotion regulation (Burić et al., 2016); these self-regulative strategies have been found to be connected to ASC. Ommundsen, Haugen, and Lund (2005) found that students with higher self-concepts were more likely to persist and concentrate on academic tasks, use strategies to organize and connect learning to prior knowledge, and less likely to engage in self-handicapping behavior. Similarly, Dermitzaki, Leonardi, and Goudas (2009) found a small relationship between students' motivational strategy usage and their ASC. Given ASC's link to regulation and emotion, understanding it in the context of medical education and the pursuit of master adaptive learners is important. In addition to strategy usage, MALs are those that aim for the development of competence and mastery in their learning environments (Cutrer et al., 2017). Individuals can take multiple approaches to these achievement contexts by setting different kinds of goals, such as learning and mastering content, proving competence to others, or avoiding appearing incompetent in front of others (VandeWalle, 1997). Learning goals have been found to be related to both performance in training programs (Brett & VandeWalle, 1999) and students' ASCs (Albert & Dahling, 2016),

suggesting that understanding students' orientations toward their tasks may be valuable to understanding how they approach their learning and their self-beliefs.

In addition to taking on learning goals, master adaptive learners are those that are oriented towards lifelong learning (Cutrer et al., 2017). Lifelong learning is a component of the ACGME competency of Practice-Based Learning and Improvement. In a study of first-year university students, Fryer (2015) found that students' ASCs were positively related to their lifelong learning attitudes; in the medical context, lifelong learning is an important element to professionalism (e.g., Nierman, 2002; Hojat, Veloski, Gonnella, 2009). Leflot, Onghena, and Colpin (2010) highlight students' interactions with their teachers as a source of self-concept development; more positive interactions were predictive of social and ASC levels, with support for students' autonomy being most significant for ASC. The relationship between teachers and students has also been identified as a mediator between students' school self-concept and their feelings of engagement, belonging, and helplessness in their school (Raufelder et al., 2013, p. 15). These social relationships are one element of the environment that can influence students' cognition and behavior in SCT.

Additionally, Marsh and Parker (1984) propose a model explaining how social and environmental factors are also critical in the formation of adolescents' academic self-concepts. Called the Big-Fish-Little-Pond Effect (BFLPE), this model accounts for individuals' perceptions of other students and their school environment as significant components of academic self-concept, which suggests that "[f]or some children the early formation of a self-image of themselves as a good student is probably more important in terms of later schooling than are small differences in their absolute level of achievement" (Marsh & Parker, 1984, p.

230). In short, this means that students who believe that they are better students than their peers will have higher academic self-concepts, but only to a certain extent.

To further expand the applicability of this model, Marsh and Hau (2003) conducted a cross-cultural study of the BFLPE across academically selective schools in 26 countries. While it would be expected for students accepted to selective academic programs to have higher academic self-concept than students in less selective environments, the opposite holds true across all the cultures sampled. While overall student achievement may still be higher, these students feel less confident in their abilities, which can lead to individual decreases in achievement. A study of students in both high- and low-ability Singaporean classroom suggests that students are sensitive to the meaning of being placed by ability (Liu, Wang, & Parkins, 2005). Lower ability students recognized their separation from higher-ability students and their ASCs suffer initially as a result, but higher-ability students suffer later because of less-favorable social comparison and the potential for less visible successes. Both high- and low-ability students' ASCs suffer over time, but high-ability students seem to suffer more.

Academic Self-Concept of Medical Students

For its long history of study, ASC research has not often placed medical students at the center of inquiry. Given these students' intense educational experiences, expanding our understanding of their perspectives may add value to educational endeavors. This is not to say that no studies have been done looking at ASC for medical students; during this literature review, five studies were found that connect ASC to this population, covering a number of topics in multiple contexts with a range of methodological approaches. These five studies will be discussed in this section:

- "The Role of Self-Concept in Medical Education"

- "Big Fish in a Big Pond: A Study of Academic Self-Concept in First Year Medical Students"
- "Medical Students' Perceptions of Their Learning Environment, Well-Being and Academic Self-Concept"
- "The Impact of Self-Concept and College Involvement on the First-Year Success of Medical Students in China"
- "Psychological Distress and Academic Self-Perception Among International Medical Students: The Role of Peer Social Support"

The Role of Self-Concept in Medical Education. Yeung, Li, Wilson, and Craven (2014) took a specific look at the role of self-concept in medical education. While not specifically targeting ASC, this article looks at self-concept broadly and aims to construct an understanding of the construct for medical students based on the three-factor framework proposed by Gecas (1991) suggesting that self-concept is driven by self-efficacy, authenticity, and self-esteem. A qualitative methodology was selected for this study to explore the question "Do medical students have an established and well-defined multidimensional structure of self-concept and motivation from a psychosocial perspective?" (Yeung et al., 2014). Eleven students from an Australian medical school, in years two through four, were sampled to discuss their motivations for becoming doctors, their perspectives on educational outcomes, the commitment to serve the underserved, and their belief in their competence over time. Responses were coded and grouped using focused coding based on Gecas's (1991) three-part framework, out of which three themes emerged: individual agency, interaction, and environment support, which related to many reasons endorsed by these participants for wanting to become physicians. For example: a reason related to self-efficacy and individual agency was to take on a challenge, while a reason

related to authenticity and interaction was to help people. This analysis reveals that self-concept creation for these students is a process that encompasses elements different to what might be considered by other populations. This active creation and context specificity comes out in students' responses. One highlighted response was particularly powerful:

> I think communicating with family and friends; has been a real reality check because particularly my parents, they told me, you don't have to know everything before you finish. You don't have to have the type of knowledge that you think that you must have because I guess I'm comparing myself to doctors (Student 7; Yeung et al., 2014, p. 806).

This statement highlights much of what we know about self-concept: it is based on experiences, socially informed, and context-specific (Shavelson et al., 1976). The authors suggest that responses such as this one reveal the dynamic and multidimensional nature of medical students' self-concepts and note that further work is necessary for other contexts to continue building this understanding, but the power of expanding this work into populations outside of adolescence opens new doors for future work. By illustrating the multidimensionality of this population, this study also lays the groundwork for the exploration of other dimensions to self-concept, including ASC.

Big Fish in a Big Pond: A Study of Academic Self-Concept in First Year Medical Students. Jackman, Wilson, Seaton, and Craven (2011) explored the BFLPE in a sample of first-year medical students in Australia using two studies: one quantitative and one qualitative. All first-year medical students (N = 133) from an Australian university were invited to participate in the study. This school's design is a five-year undergraduate program designed to bring in a student body with diverse experiences, including those who have left school and graduates of other degree programs. Twenty students volunteered for the quantitative portion of the study,

examining change in ASC (using six items from SDQ II: Marsh, 1992) and self-evaluation (one item asking "How much better/worse are you academically compared with most of the other students in your year": Jackman et al., 2011) across two semesters. Results indicated no significant change in either measure between the two time points. The qualitative study consisted of five semi-structured focus groups with a total of 26 students, where students were asked about their perceptions and evaluations of academic performance as well as their perceptions of their peer groups. Several themes emerged regarding performance, mostly relating to students' attributions for that performance. Some students attributed poor performance to external sources, while others attributed it to internal factors—namely effort. In terms of the peer group, most students (58%) in the focus groups suggested that their peers were slightly competitive, while the remainder felt their peers were not competitive. The authors note that while self-concept levels did not appear to change over students' coursework, the external attribution styles used by students are not associated with positive self-concept. Both studies were based on small sample sizes, which the authors note, but they also note the value in exploring these concepts within this context. This study offers a beginning of an understanding but given its small scope and the different educational context, it does not directly address the needs of understanding ASC in this current CBE climate. It is also valuable that while small, this sample brought up the value of effort, which supports the use of the ASCS.

Medical Students' Perceptions of Their Learning Environment, Well-Being and Academic Self-Concept. Litmanen, Loyens, Sjöblom, and Lonka (2014) took a quantitative approach to exploring the relationships between students' perceptions of their learning environment, their well-being, and ASC. Six hundred and ten students were sampled from three medical schools in Finland, with students representing a range of preclinical and clinical

experiences. These schools' curricula are based on a six-year model where students spend two years in the clinical phase and the rest of their time in clinical training and working with patients. Data for the study came from the MED NORD questionnaire (Lonka et al., 2008) which captures elements of students' well-being (e.g., exhaustion and lack of interest) and their perceptions of the learning environment (e.g., as disengagement and receiving feedback). ASC was measured with a single item asking students to rate themselves in relation to their peers. "Respondents were asked to indicate whether their typical grade was worse than the average grade of their class, approximately the same as the average of their class, or better than average" (Litmanen, Loyens, Sjoblom, & Lonka, 2014, p. 1860). Results of analyses using structural equation modeling (SEM) suggest three statistically significant relationships between well-being and learning environment perceptions with ASC: Students' perceptions of their workload are negatively correlated (-0.25) with ASC as is students' lack of interest (-0.26), while exhaustion is positively correlated with ASC (0.16). The authors highlight these findings and suggest their importance when it comes to the future development of students, suggesting that if interest and factors relating to burnout are significantly related to perceptions of competence in medical school, those relationships may extend into practice, which the authors extend to potential opportunities for curricula:

> "Given the present findings, students' well-being might be increased by tackling their experiences of high workload and worry about their current and future stress. At the beginning of their studies, this might be facilitated by helping students obtain necessary study skills for dealing with complex and extensive amounts of information. To prevent problems later on during their career, it is advisable to be aware of the early signs of burnout that begin developing during medical school. It would also be important to find

ways to deal with their career choice satisfaction and how education prepares them for it" (Litmanen et al., 2014, p. 1865).

This information and analysis connect ASC to students' experiences using a large sample, but for this study, the quantitative understanding of ASC is limited to a single item. Further exploration using larger samples and more nuanced measurement of ASC will be important to more fully understand students' perceptions of competence.

The Impact of Self-Concept and College Involvement on the First-Year Success of Medical Students in China. Zhou and colleagues (2015) came at ASC from yet another perspective by taking a longitudinal perspective on the success of first-year medical students in China, examining self-concept and involvement. Both academic and social self-concepts were measured, although the specific scales and items used are not identified in the article. This makes it difficult to compare findings in a measurement sense, and to establish validity for the findings, but can still be used as an exploration of ASC within the population of medical students. All matriculating students were sampled, but only 519 students were able to be matched between the two time points in the study. Data were collected prior to the start of students' coursework and at the end of their first year. Ultimately, the authors were looking to predict students' GPA at the end of their first year, with a theorized model where demographics predict pre-college self-concept, which in turn influences students' interactions with their learning environment, which predicts end-of-year self-concept, finally predicting students' academic outcomes. The authors used path analysis to better explore these relationships. While many significant paths emerged, for the purposes of this review only those relating to academic self-concept will be discussed here. The only significant predictor of students' pre-college ASC is their entrance exam score (0.20). In turn, pre-college ASC predicts faculty interaction (0.09) and ASC at the end of year

one (0.32). Homework time on task (0.14), faculty interaction (0.17) and pre-college social self-concept (0.12) also predicted the end of year one ASC. In the end, this final ASC outcome only weakly predicted students' first year GPA (0.10). The totality of the model accounted for 24.79% of the variance in students' first year GPA. While the authors suggest that the predictive validity of this model is unsatisfactory, they do highlight the value of the findings:

> "the pre-college and college effect indicates that academic self-efficacy beliefs become even more critical for health care professionals as they attempt to exercise control over their own learning in progressively more independent, technology-mediated learning environments" (Zhou et al., 2015, pp. 174-175).

This study leaves us with questions, particularly related to measurement and variable operationalization, but as one of only a few studies looking at ASC in medical students, some use can still be taken from it. It highlights the importance of ASC when it comes to student outcomes and its use of social data fits well with modern curriculum trends highlighting teamwork and the value of social interactions for ASC. While their data may not support it, it is also heartening to see connections made between ASC research and the development of master adaptive learners.

Psychological Distress and Academic Self-Perception Among International Medical Students: The Role of Peer Social Support. Yamada, Klugar, Ivanova, and Oborna (2014) examined the relationships between psychological distress, academic self-perceptions, and social support in a sample of international medical students in the Czech Republic. One hundred thirty-eight students' responses to three instruments were analyzed. While psychological distress and social support were measured, of interest to this study is that students' perceptions of their academic performance were measured using a subscale of the Dundee Ready Education Environment Measure (DREEM; Roff et al., 1997). DREEM was designed to be context neutral

and has been validated across a range of different cultural contexts. The academic self-perceptions subscale includes items such as "I am confident about passing this year" and "I am able to memorize all I need." While not directly labeled as such, these statements capture competency elements like ASC. Results of the analyses indicated that psychological distress and social support were both negatively related to students' academic self-perceptions and that students with both low social support and psychological distress are more likely to possess low negative academic self-perceptions. While these self-perceptions were not the core focus of this study, these results fit well into the broad theoretical background of ASC research. The authors suggest that medical schools should give attention to enhancing peer relationships and promoting cooperative, rather than competitive, goal structures. Given what is known about ASC in high-achieving environments, this call to medical schools is meaningful. Further understanding of these relationships is an important step. This study represents an investigation that is close to the study described in this dissertation but leaves room for this research to continue adding evidence. For example, the DREEM subscale used consists of a single factor and is not linked to any direct measurement of performance. Expanding upon these facets will provide value to our knowledge of medical students' school experiences and ASCs.

The Present Study

The five studies mentioned above provide an important starting point for future research, but there are critiques to be made about each study. Table 4 presents a short summary of outcomes and critiques about these five studies for comparison.

Table 4

Comparison of Academic Self-Concept Studies with Medical Students

Study	Sample	Question	Outcomes	Critique
Yeung, Li, Wilson, & Craven, 2014	11 Australian medical students in years 2-4	Do medical students have an established and well-defined multidimensional structure of self-concept and motivation from a psychosocial perspective?	Medical student self-concepts are actively created around individual agency, interaction, and environmental support.	Not focused on academics.
Jackman, Wilson, Seaton, & Craven, 2011	26 Australian medical students in year 1	Do academic perceptions change across two semesters? How do students perceive academic performance and peer groups?	No significant change in ASC occurred. Students' attributions were related to ASC.	Small sample size for quantitative phase.
Litmanen, Loyens, Sjöblom, & Lonka, 2014	610 Finnish medical students across different clinical and preclinical phases	Are well-being and learning environment related to ASC?	Perceptions of workload and lack of interest are negatively correlated with ASC, while exhaustion is positively correlated.	ASC indicated with a single item.
Zhou, Ou, Zhao, Wan, Guo, Li, & Chen, 2015	519 Chinese first-year medical students	Do self-concept and learning environment predict academic outcomes?	ASC weakly predicts GPA and is predicted by entrance exam scores, faculty interaction, time on task, and social self-concept.	ASC scale and items not reported.
Yamada, Klugar, Ivanova, & Oborna, 2014	138 international medical students in the Czech Republic	Are psychological distress, social support, and academic self-perceptions related?	Psychological distress and social support were negatively related to academic self-perceptions.	ASC nested in larger instrument focused on learning environment, not ASC.

If we want to facilitate the professional development of physicians who are mastery-focused and engaged in and committed to lifelong learning, we need to understand academic competencies of these future physicians. However, the lack of research into ASC for medical students makes this

connection difficult to establish. This study aims to address this gap by exploring the ASCs of medical students in the context of empirically supported relationships based on other populations, while also investigating academic beliefs that may be unique to this population. By understanding this piece of medical students' experience in medical school, we will be better able to establish connections between their early experiences and longitudinal development over time. This is particularly significant in the context of CBE. ASC is theoretically linked to elements of core competencies and developing goals of producing master adaptive learners, so examining the validity of a tool for measuring ASC gives us not only a window into students' experiences, but with statistical modeling will also allow us to link students' academic and professional competencies to performance indicators. This work, then, not only supports the validation of a novel measure for this population but also provides evidence for the validity of students' perceived academic competence and professional competencies as predictive of success in medical school. Research suggests that ASC is valuable for understanding students' experiences for students across the spectrum from kindergarten to undergraduate work (e.g., Schmidt et al., 2017; Marsh et al., 2016; Green et al., 2012), so there is theoretical support for it having value for medical students, and clear links exist between conceptualizations of adaptive medical learners and the kinds of information we can learn about students through ASC. Medical school is an intense experience, and the social-comparative elements of the process may relate to social-comparative elements of ASC that suggest higher-performing students' self-concepts suffer in high achieving environments. Providing sound evidence for this value will be important not only for the study of ASC, but also for the study of medical students and their transition from novice to expert, which can be a challenging process. These perceptions of competence are also valuable when it comes to understanding other elements of student development. Given

empirical support in the literature for positive outcomes such as motivation, attitude, and performance, we should expect academic competence to play a role in the positive development of medical learners. Finally, by developing this understanding as it relates to medical students at the earliest points in their career, it may be possible to recognize areas where students need additional support along their journey. Given the broad goal of medical education to produce the best, most competent physician possible, any additional understanding that we can build about our students will help us to better reach those goals. By focusing on these student perceptions in a systematic way, this study will enrich the scientific bases of ASC and medical education by providing a perspective that is more sensitive to individuals' needs as students and as developing physicians.

Chapter Three
Methodology

This chapter details the methodology used in this study to address the two-fold goals of this project: 1) further our understanding of medical student learning by providing validity evidence for the ASCs of medical students, and 2) improve our measurement capabilities in understanding the MAL. Specifically, two broad research questions and several sub-questions drive this inquiry:

1. Does the Academic Self-Concept Scale (ASCS) provide valid information about the ASCs of first-year medical students?
    a. Are ASCS scores reliable based on Cronbach's alpha?
    b. Is ASC correlated with goal orientation, academic emotion regulation, and lifelong learning orientation?
        i. Does collinearity exist between ASC and any of these other constructs?
    c. Does the established factor structure of the ASCS hold for this novel population?
    d. Are students' ASCS scores predictive of performance on academic and clinical assessments?
    e. Which subscale score is more predictive of performance?
2. Do existing tools linked to conceptualizations of MALs form distinct factors and predict student performance differently?
    a. What items are most strongly related to performance?

b. Can a composite MAL scale be created?

c. What distinct clusters emerge based on scale scores?

d. Does cluster membership predict differences in students' performance outcomes?

This chapter discusses study design, sampling, and data; additionally, processes for checking assumptions of statistical analysis are detailed. Once these points have been outlined, proposed methods for data analysis are described in detail.

Background

All research is conducted within the context of the researcher's experiences. While we all bring our own sets of interests to projects that can determine their direction, it is in the methodology that these personal factors can shape what is done and how it is accomplished. This is true of both qualitative and quantitative research. So, in the way a qualitative researcher would bracket their experiences, here I discuss briefly my connection to this data and the access it afforded me. I have been interested in self-concept research from the early days of my doctoral program and through various attempts have tried to conduct research that extends our understanding of the construct; it was often too broadly focused and not grounded in the needs of a specific population. That changed with an opportunity to work with the Office of Assessment, Evaluation, and Scholarship (AES) on projects relating to the broad evaluation of the curriculum at this medical school. Driven by the dearth of substantive studies of medical students' self-concepts but also by support from faculty within AES, I continued to explore this topic. Through this work, I became intimately involved in the development and creation of a longitudinal database for curriculum evaluation and research on our medical students. This database allows us to track students at the individual level from admissions through internship and eventually into practice. After discussions with faculty in AES and in the curriculum office, I was able to make

the case for including a self-concept instrument on our annual surveys for curriculum improvement as a possible way of understanding our students and their development in a different way that relates to their developing professional identity, lifelong learning, and competencies.

Research Design

To best address the research questions, a quantitative approach was used. Questions around establishing validity evidence and data reduction can be best answered using quantitative methods, but given the data in use, it is important to note that this study is non-experimental and did not represent an attempt to influence any outcomes. Given the scarcity of research on ASC when it comes to medical students, it is important to examine the structure of students' beliefs in the context of previously validated instruments and in doing so, examining patterns that emerge between scales will become possible. Expanding the validity evidence available for the instrumentation to be used is an important step in furthering our ability to measure ASC. A quantitative approach, grounded in predetermined question and response options (Creswell, 2015) is necessary to bring these ideas together in a way that will provide answers to the research questions.

ASC is understudied when it comes to medical education, so an important first goal was to illustrate how the construct functions in this context. By using a measure of ASC validated for a different context—the Academic Self-Concept Scale (ASCS; Liu et al., 2005)—this study adds to the current body of knowledge by providing evidence for the structure of medical students' ASC. The two-factor structure of the ASCS provides a good starting place for this analysis. Confirmatory factor analysis was used to see if medical students' ASCs fit the same structure as those of other groups. At the same time the correlation between ASC and achievement is

strongly supported in the literature and establishing any potential predictive ability of ASC will be valuable for future research and for curriculum designers. Establishing this connection was an important component of the validation process. Data on students' academic emotion regulation, goal orientation, and lifelong learning orientation were also collected to provide convergent validity evidence and linkages between ASC and conceptualizations of good medical learners. Response data came from a secondary data source in the form of curriculum evaluation data gathered from all first-year medical students enrolled in the M.D. program of a large urban medical school in the Mid-Atlantic. Initial data were collected at students' orientation as part of ongoing curriculum evaluation work and follow-up data was collected at the end of students' first-semester coursework related to the scientific foundations and practice of medicine. Statistical analyses—including confirmatory factor analysis (CFA), exploratory factor analysis (EFA), and cluster analysis—were conducted to determine and explore the relationships between students' individual differences, their performance in medical school, and their ASC.

Conceptual Framework

Measurement of ASC. Given its long history, ASC has been measured using a wide variety of instruments (examples include the Academic Self-Concept Scales: Brookover, Thomas, & Patterson, 1964; Rosenberg Perceived Self-Concept Scale: Rosenberg, 1979; Self-Description Questionnaire III: Marsh, 1992; and the School Attitude Assessment Survey-Revised: McCoach & Siegle, 2003). These scales operate from slightly different conceptual frameworks and are used with different populations, so there is no scale that is used universally to capture the construct. As described in Chapter Two, the extant work on ASC in the medical student context is small and no consensus on the best instrument to use exists. One tool exists to capture ASC in medical students in the DREEM (Roff et al., 1997), but the academic self-

perceptions subscale is nested within a larger instrument designed to capture students' perceptions of their learning environment. This broader focus leaves room to continue exploring ASC, and because most studies using this instrument are conducted in an international context, validation efforts are still necessary.

The Academic Self-Concept Scale (ASCS; Liu et al., 2005) was selected for this study because of its two-factor structure for ASC for both measurement and theoretical reasons. This scale captures students' competence and effort perceptions; this structure provides a base on which to perform CFA to align students' responses from this sample with that in the original article. At the same time, the addition of an effort subscale to the traditional competence scale helps to link ASCS to the medical student population. In the two qualitative studies of medical students and self-concept described in Chapter Two (Yeung et al., 2014; Jackman et al., 2011), students described elements of their own effort as a part of the self-concepts. During the literature review, no other study dedicated a subscale to effort; it is fitting given medical students' own endorsement of effort that it be included when trying to measure their ASCs, which will both extend our knowledge of first-year medical students and provide additional opportunities for validation and analysis.

Measurement of MAL. MAL as it is currently understood consists of several core areas, each composed of specific self-regulative attitudes and strategies. White and Gruppen (2010) identify these areas (or phases) as planning, learning, assessment, and adjustment, and highlight elements of each of these phases. While these individual components have measurements that exist to capture them, no single tool exists to capture all of MAL. The development of such a tool is valuable because attempting to collect data on all these sub-components would be difficult, especially given the large level of survey fatigue already faced by students (Porter, Whitcomb, &

Weitzer, 2004). It is important to note that MAL consists of several phases and this study only aimed to condense findings relating to the planning and learning phases. Cutrer and colleagues (2017) suggest that each of these phases works in relation to the others, and that understanding one will increase our understanding of the whole.

MAL was a timely framework for AES to understand the students at the medical school it supports. Change (and ideally growth) in physicians has long been a topic of study (e.g. Knox, Charters, & Blakely, 1973). Adaptive expertise, using daily practice to learn through practice (Myopoulos & Regehr, 2009), is one element of this continuous learning that is particularly valued within the dynamic nature of clinical environments. At the same time, the Liaison Committee on Medical Education and the Accreditation Council for Graduate Medical Education are placing greater focus on the development of self-directed learners during and after medical school. MAL is a valuable way to build an understanding of this learning across the continuum. Given the role AES plays in supporting student development in undergraduate, graduate, and continuing medical education, MAL was decided on as a framework because of behavioral and cognitive elements applicable in all these contexts.

Procedure

Sample. The sample of this study consisted of first-year medical students at a large, Mid-Atlantic medical school who began their medical education in the fall of 2017. As part of their orientation to the medical school, students completed personality and individual difference instruments administered through AES. For this study, data took the form of secondary data from the curriculum evaluation data developed and maintained by AES. This data represented a subset of the database relating to students in the graduating class of 2021. The database is organized longitudinally such that all data pertaining to an individual can be linked and tracked across their

educational experiences. This provides a great deal of utility for answering curriculum evaluation questions but can also be used in a research context by fully de-identifying the data. For this study, students will be identified using a unique identifier that cannot be linked to any other data that might lead to their identification.

The class of 2021 consists of 215 students, of which 205 students completed the survey at orientation (a response rate of 95%). The mean age of the sample was 24.79 years. A majority of the sample identified as male (51.2%). Students identified as White (42.4%), Asian (29.3%), Black or African American (18%), Hispanic or Latino (4.4%), Two or More Races (0.5%), or Other (2%). Seven respondents (3.4%) did not provide a response.

While this data is being treated as archival, secondary data, the original sampling of these students was a nonprobability convenience sampling procedure. This is a sampling method that is based on the judgments of the researcher based on accessibility to the sample (McMillan, 2015). Secondary data analysis in this case allows for this research to be based on a nearly complete sampling of this medical school class while not exposing participants to the unnecessary risk of privacy violations. At the same time, the use of this data also benefits the study because the history of use of these instruments is available on which to evaluate current findings. For these reasons, secondary data analysis is becoming a more widely used method for social science research (Vartanian, 2011).

Student data. Surveys were administered by AES during students' orientation week as part of curriculum evaluation. Completion was optional. A representative of the curriculum office briefly introduced the survey and was followed by a more in-depth explanation by a member of AES who explained not only the purpose of the survey for evaluation but also provided information about the protection of student information and clarified that survey

completion was optional. Only members of AES ever have access to identifiable student data. Students were informed that no individual with authority over grades or standing will have access to identifiable data and that any reports made will be made in aggregate. Physical surveys are stored in locked cabinets and electronic files are stored on secure servers only accessible to members of AES. For use in research, data is de-identified and students are assigned a new random identifier.

Student grade outcomes came from an SQL database maintained by the Office of Academic Information Systems. Access to this database is strictly controlled to protect student information. Data was pulled from this system and merged with student survey data prior to deidentification. Access to this data is allowable given the role of AES, and the use of de-identified data in a secondary manner was approved by the VCU IRB (HM20013302).

Measures.

Lifelong learning orientation. Students' approach towards continuing education was measured using the Jefferson Scale of Physician Lifelong Learning—Medical Students (JSPLL-MS; Wetzel, et al., 2010). This scale contained 14 items, and items were answered using a four-point Likert-type scale from 1 (strongly disagree) to 4 (strongly agree). This scale demonstrates acceptable internal consistency ($\alpha = 0.77$). This scale captures three factors: learning beliefs and motivation ($\alpha = 0.70$), skills in seeking information ($\alpha = 0.61$), and attention to learning opportunities ($\alpha = 0.59$). The original form of the scale (Hojat et al., 2003), designed for physician use, has been extensively used in a range of clinical settings, but the medical student version (cited 13 times based on a Web of Science review) appeared to have only been used once before. Mi and Halalau (2016) conducted a small quantitative study on resident physicians using the JSPLL-MS that suggests a relationship between lifelong learning orientation, evidence-based

medicine skills, and information management. While these findings add minimal validity evidence to the use of the JSPLL-MS, the widespread use of the original and the similarity between the two instruments (e.g. "I enjoy reading articles in which issues of my professional interest are discussed" in the original became "I enjoy reading articles in which issues of medicine are discussed" in the medical student version) suggests that this scale is an appropriate tool for reporting information about students' lifelong learning.

Goal orientation. Students' goal orientation was measured using a 13-item instrument capturing three factors of goal orientation: learning ($\alpha = 0.78$), performance-prove ($\alpha = 0.81$), and performance-avoid ($\alpha = 0.88$; Brett & VandeWalle, 1999). Important to note is that these three subscales are not combined and are interpreted individually. Questions were answered on a 7-point Likert-type scale where 1 is "strongly disagree" and 7 "is strongly agree." To make survey completion easier, data in the database was collected on a four-point Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree). This scale has been widely used (cited 170 times according to Web of Science) across a range of contexts; many of these uses are for organizational training contexts (e.g. Blau, Petrucci, & Rivera, 2018; Heidemeier, Wiese, & Hurrell, 2014), but use in the medical context exists as well. Bose and Gijselaers (2013) suggest that residents who are more performance-avoid-oriented may seek out less feedback from supervisors, while results from a study of medical students suggests that those with learning goal orientations perform better than those with performance goal orientations when few set external goals exist (Gardner, Diesen, Hogg, & Huerta, 2016). Given the dynamic and often ambiguous nature of medical education and the clinical environment, this scale produces valuable information about students and their task motivation.

Academic emotion regulation. Students' academic emotion regulation was measured using the Academic Emotion Regulation Questionnaire (AERQ; Burić et al., 2016). AERQ uses eight subscales rated on a five-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree). Internal consistency for each subscale is acceptable: Avoiding situations (α = 0.71), developing competencies (α = 0.73), redirecting attention (α = 0.72), reappraisal (α = 0.72), suppression (α = 0.73), respiration (α = 0.82), venting (α = 0.81), and seeking social support (α = 0.79). To make survey completion easier, data in the database was collected on a four-point Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree). A Web of Science search indicated that this instrument has only been cited one other time; the citation was not a use of the scale, so validity evidence of the scale for use in the medical context does not exist. This instrument was selected for the curriculum evaluation inventory because of the relationship between emotion regulation and students' emotional responses to their academic environments (e.g. Gumora & Arsenio, 2002; Ben-Eliyahu & Linnenbrink-Garcia, 2013). It was also selected to represent a behavioral element that is not captured in other scales included in the curriculum evaluation.

Academic self-concept. ASC was measured using the Academic Self-Concept Scale (Liu et al., 2005). This scale consists of 19 items rated on a four-point Likert-type scale ranging from 1 (strongly disagree) to 4 (strongly agree), capturing two subscales: confidence and effort. While reliability evidence for medical students has not been established, results from a sample of high school students shows strong internal consistency (α = 0.82) for the whole scale and adequate reliabilities (α = 0.71 and 0.76) for the confidence and effort subscales respectively (Liu et al., 2005). Additionally, items 2, 4, 7, 9, 11, 13, 15, 16, and 19 are negatively worded and were recoded (1=4 and 4=1). Additional uses of the survey in the same population as original

validation (Liu & Wang, 2007; Liu & Wang, 2008) provide further evidence of validity in its original context, but in the 33 citing articles from a Web of Science search, none used the scale in a different context. To ensure the scale was appropriate to use in this novel population, items from the ASCS were compared to items from the academic subscale of the Self-Description Questionnaire III (SDQ III; Marsh, 1992) as shown in Table 5.

Table 5

Comparison Between ASCS and SDQ III Items

ASCS Item	SDQ III Item
1. I am usually interested in my school work.	I enjoy doing work for most academic subjects.
2. I study hard for my tests.	I hate studying for many academic subjects.
3. I often forget what I have learned.	I like most academic subjects.
4. I always do poorly in tests.	I have trouble with most academic subjects.
5. My teachers feel that I am poor in my work.	I am good at most academic subjects.
6. I day-dream a lot in class.	I am not particularly interested in most academic subjects.
7. I can follow the lessons easily.	I learn quickly in most academic subjects.
8. I often feel like quitting school.	I hate most academic subjects.
9. I am good in most of my school subjects.	I get good marks in most academic subjects.
10. If I work hard, I think I can go to the Polytechnic or University	I could never achieve academic honors, even if I worked harder.

SDQ III is a widely-used instrument for capturing a range of self-concepts in late adolescents to adults, and while there is not a one-to-one relationship between the items on the ASCS to the SDQ III, there is a clear overlap in content. Because of these relationships in content, the ASCS was determined to be an appropriate measure of students' ASCs. It is also important to note that despite the wider body of evidence for the SDQ III, the length of the ASCS and the inclusion of an effort factor endorsed by medical students made the ASCS a better choice for this study.

Scale content. These scales were selected because their content fits well with the conceptual frameworks for ASC and MAL. Figure 3 shows White and Gruppen's (2010) model of SRL in medical education, which serves as a backbone of the MAL framework. By distilling these cognitive, motivational, and behavioral constructs into representative behaviors for each MAL phase, a more concrete picture of what MALs do in their learning emerged. As such, returning to core constructs was an appropriate way to begin measurement of these phases. Academic emotion regulation falls within the learning and assessment phases as it relates to students' self-assessment and regulatory strategies; goal orientation and lifelong learning orientation are within the planning phase as they relate to students' motivation for task choice and engagement. ASC should also be considered an element of the planning phase given its relationships to self-efficacy and students' motivation. The use of the ASCS to measure ASC is appropriate based on the scale development conducted by Liu, Wang, and Parkins (2005), as well as the identified factors connection to qualitative responses from medical students collected by Yeung, Li, Wilson, and Craven (2014) and Jackman, Wilson, Seaton, and Craven (2011).

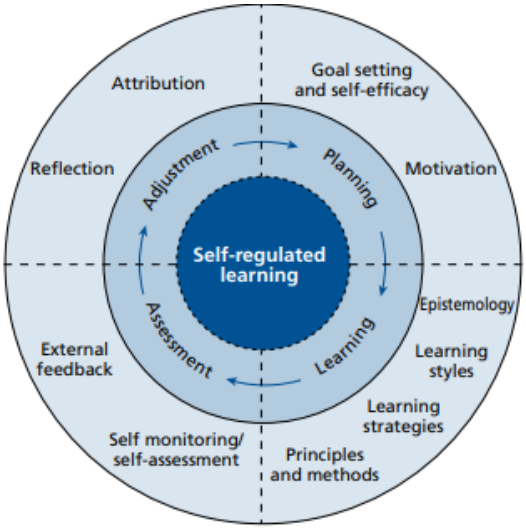

Figure 3. White and Gruppen's (2010) model of SRL in medical education.
Note. Adapted from "Self-Regulated Learning in Medical Education" by C.B. White and L.D. Gruppen (pp. 271 282), in T. Swanwick (ed.) *Understanding Medical Education: Evidence, Theory and Practice*, Oxford, United Kingdom: Wiley-Blackwell.

Demographics. Demographic information including age, race, and gender was collected from students.

Outcomes. The final data element in this analysis came from students' grade components. Four grades were selected to be included:

- Molecular Basis of Health and Disease exam score
- Practice of Clinical Medicine exam score
- Practice of Clinical Medicine OSCE score
- Foundations of Disease exam score

Students' first medical school examination was Molecular Basis of Health and Disease, used to gauge early experiences with the curriculum and the relationship between ASC and performance. Practice of Clinical Medicine (PCM) and Foundations of Disease are two of students' final grade outcomes for their first semester. Where Foundations of Disease captures scientific knowledge, PCM aims to teach students about the practice of medicine and patient interaction. By comparing grade outcomes from two domains (scientific and clinical), the goal was to show discrimination based on students' ASCs. Finally, students engage in a standardized patient encounter as part of PCM, and this score was analyzed in relation to ASC for similar discriminatory purposes.

These grades were selected to examine students' development into what we think of as good doctors. A key element of success in the profession is a wide body of medical knowledge and the knowledge of the underlying scientific principles. Atlantic Medical School's new curriculum aimed to increase the integration of clinically relevant information throughout students' basic science courses so that all courses could be directly applicable to students' clinical successes. As such, these four grades were chosen to represent a range of important facets of medical education. Molecular Basis of Health and Disease and Foundations of Disease

were selected to represent students' core basic science knowledge and the foundation on which they will build more direct clinical knowledge. PCM and the PCM OSCE were selected to capture information about students' broad knowledge of clinical interactions and an example of the specific interactions. While the students in this sample are only in their first year, these outcomes give some depth to our understanding of them as developing physicians.

Missing data, outliers, and power. Two hundred and five surveys were obtained and linked with student outcome data. Of these 205, 179 contained complete participant information. Of all the variables, students' Foundations of Disease grade had the largest number of missing values. There are a wide variety of reasons why students may not have a grade, including withdrawal, a leave of absence, remediation or otherwise. Because Foundations of Disease is the last course in students' first semester, the higher number of missing data points is due to the buildup of these reasons. Given the underlying assumption that missing data are missing completely at random, or that missingness is not related to any other variable, Little's MCAR test (Little, 1988) was run to determine if there was a pattern of missingness. The test was significant at the 0.05 level, indicating a pattern of missingness related to other variables. Thus, listwise deletion is inappropriate as the data are not missing completely at random (Little, 1988). Given a pattern of missingness in the data, the Full Information Maximum Likelihood method (FIML; Hartley & Hocking, 1971; Dong & Peng, 2013) was used instead of multiple imputation. Unlike multiple imputation methods, FIML does not generate values for missing data but instead estimates data based on all available information.

The data were also analyzed for outliers, as the inclusion of extreme values can unduly influence results of analyses. Box plots were used to identify cases that fell significantly outside the range of the other cases. While no outliers emerged in the survey data, two extreme cases

were identified in the outcome data. One participant had three scores between zero and 30 percent on grade outcomes and the other had a true zero on one examination. These cases were removed, bringing the effective sample size to 203. Finally, to interpret data as meaningful, it is important to have a sample that is large enough to detect an effect if one exists (Cohen, 1988). A common guideline for structural equation modeling is to include 5 cases for each parameter in a model (Mueller & Hancock, 2010). In this case, 22 parameters are present, necessitating a minimum of 110 participants, while Muthén and Muthén (2002) suggest that to perform CFA on data with missingness, a sample size of 175 is necessary to reach a statistical power of 0.81. Bandalos and Finney (2010) suggest a sample size of at least 500 for an EFA with seven factors. So, while the sample for this study is sufficient for the CFA, it is important to note that this model is under-powered for EFA, thus increasing the chance that actual effects may not be detected.

Academic Self-Concept Scale validation. Validity is defined as "the degree to which evidence and theory support the interpretations of test scores for proposed uses of tests" (AERA, APA, & NCME, 2014, p. 11). Based on suggestions from *The Standards for Educational and Psychological Testing* (AERA et al., 2014), three main sources of validity evidence were evaluated for the ASCS.

Evidence based on test content. One major source for validity evidence is the relationship between test content and the construct to be measured. The ASCS was developed "with reference to Battle's (1981) Academic Self-esteem subscale, Marsh et al.'s (1983) School Subjects Self-concept scale, Piers and Harris' (1964) General and Academic Status scale, and Quek's (1988) ASC scale" (Liu et al., 2005, pp. 573-574). Given the previously established test content evidence established by the authors of the scale, this source of evidence was the least

focused on in this study. It was not, however, ignored, as one item was changed to better reflect the change from the high school to the medical school context. In the original scale, item number 5 reads "If I work hard, I think I can go to the Polytechnic or University." The version in this study reads "If I work hard, I think I can match well for residency." Specific attention was given to this item to determine if this wording aligns with the content established by the rest of the items. Additionally, items were compared with a widely-used ASC instrument to ensure the content measured was similar (Table 5).

Evidence based on internal structure. The next step was to build evidence based on the internal structure of the items in the scales. Given the pre-existing factor structure of the ASCS, dimension reduction via confirmatory factor analysis (CFA) was used to test and validate the structure of the items (Tabachnick & Fidell, 2007; Acock, 2016). Before conducting the CFA, the assumptions of normality, multicollinearity, and sphericity were assessed. A histogram and descriptive statistics were used to assess normality; items with skewness or kurtosis values greater than ±2 were considered non-normal (Field, 2013). Multicollinearity was assessed using a correlation matrix of all the items to be included in the analysis. Any items with a correlation higher than 0.90 were examined to determine if they should be included (Field, 2013; Tabachnick & Fidell, 2007). Bartlett's test of sphericity (1954) was conducted to ensure that the correlation matrix among variables was not an identity matrix. To determine the fit of the data to the theorized two-factor model, chi-squared (ideally non-significant), confirmatory fit index (CFI; ideally greater than 0.95), Tucker-Lewis index (TLI; ideally greater than 0.95), and root mean square approximation of error (RMSEA; ideally less than 0.06) were calculated (Kline, 2005). A model meeting these criteria would be classified as a good fit to the data. Given the lack of fit, an exploratory factor analysis was performed to identify patterns in the data different

to those in the original scales. Items that were significantly cross-loaded on another factor (a loading of 0.3 or greater) were analyzed and a decision of where to include them based on theory was made. A reliability analysis was performed on the new factors of the ASCS that emerged because of the EFA. A common tool for generating reliability estimates is Cronbach's Alpha (Cronbach, 1951), but the Alpha calculations rely on statistical assumptions that are often violated in the use of psychological scales that can result in the inaccurate reporting of reliability (Dunn, Baguley, & Brunsden, 2014). McDonald's (1999) Omega is a measure of internal reliability that relies less on the strict assumptions of Alpha and can provide more accurate internal reliability information. An alpha value of 0.70 or higher is typically considered to be acceptable (Nunnally, 1978), and for the purposes of this study, the same cutoff was used for Omega. In this case, an omega value of 0.70 would indicate that 70% of the variance in factor scores is attributable to individual differences. Factors were analyzed and items that decreased the Omega value were removed.

Evidence based on relationships to other variables. The final piece of validity evidence to be established was evidence based on relationships to other variables. Multicollinearity, as analyzed in the previous step, is the first piece of evidence here. The literature supports relationships between ASC, goal orientation, emotion regulation, and lifelong learning, but an overly high correlation is indicative of problems in the scales. These relationships provided evidence for convergent validity. Finally, the literature supports a positive relationship between ASC and academic performance, so correlations between students' grades and their reported ASC were calculated to identify the nature and strength of those relationships.

Master Adaptive Learner Scale construction. The next step in this study was to construct a shortened scale for measuring MAL based on the four instruments collected. Scales

were included in this process if they demonstrated acceptable reliability and were positively correlated based on the results of the validity study. To construct the MAL scale, an exploratory factor analysis (EFA) was conducted to examine structures within the data (Field, 2013; Tabachnick & Fidell, 2007). The same assumptions that were checked for the ASCS were checked for the other scales to be included (normality, multicollinearity, and sphericity). An EFA using oblique rotation was performed and factors with an eigenvalue greater than one (Kaiser, 1960), and those appearing most significantly on a scree plot were extracted (Field, 2013). Oblique rotation was selected because evidence exists that these scales are related, and this rotation accounts for those relationships (Tabachnick & Fidell, 2007). At this point, factors were analyzed based on the loadings of individual items and the reliability of items grouped into factors. Items that were significantly cross-loaded on another factor (a loading of 0.3 or greater) were analyzed and a decision of where to include them based on theory was made. Items were removed from the scale to improve reliability. In the case that items from different scales loaded together, no alterations to scoring or coding were made. This study is not a validity study for scales other than the ASCS and the decision to not edit items on other scales reflects this. This decision resulted in less clear factor interpretations, but these interpretations were accurate with regards to the original scales. Future work will be necessary to provide validity evidence for these other scales to make changes to these items.

Cluster analysis. The next step was to perform a cluster analysis to identify groups of students based on their responses. Cluster analysis allows data to be grouped so that observations in a group are like one another and dissimilar to observations in other groups (Pastor, 2010). A hierarchical cluster analysis using Ward's method (Ward, 1963) was conducted and a dendrogram analyzed to determine the number of clusters. To confirm these findings, a k-means

cluster model with the specified number of clusters (two) was performed and groups were identified by mean scores. These cluster scores were then compared in terms of outcomes using a T-Test to examine differences in scale scores and performance based on group membership.

Chapter Four
Results

This chapter details the findings of the analyses described in Chapter Three and will discuss each element of the Academic Self-Concept Scale (ASCS) validation and the Master Adaptive Learner (MAL) scale construction. The discussion will outline key assumptions made about the data (e.g. missing data, outliers, and power), and then descriptive statistics. Next, evidence for the validity (test content, internal structure, and relationships to other variables) of the ASCS will be discussed, followed by the presentation of the dimension reduction and construction of the MAL scale. To reiterate, this study addressed two core research questions:

1. Does the ASCS provide valid information about the ASCs of first-year medical students?
2. Do existing tools linked to conceptualizations of MALs form distinct factors and predict student performance differently?

Results present mixed results for the validity of the ASCS and suggest that a composite tool for MAL does not differentially predict student performance. These are meaningful findings that will be explored in more depth in Chapter Five.

Descriptive Statistics and Statistical Assumptions

Survey responses. Frequencies and descriptive statistics for the collected surveys are included here: Lifelong Learning (Table 6), Academic Emotion Regulation (Table 7), Goal Orientation (Table 8), and Academic Self-Concept (Table 9).

Table 6

Lifelong Learning Scale Response Frequencies and Descriptive Statistics

		N	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean	Standard Deviation	Skewness	Kurtosis
1.	Searching for the answer to a question is, in and by itself rewarding.	203	2 (1.0)	17(8.4)	**141(69.5)**	43(21.2)	3.11	.570	-.313	1.420
2.	Life-long learning is a professional responsibility of all physicians.	203	0	0	38(18.7)	**165(81.3)**	3.81	.391	-1.616	.617
3.	I enjoy reading articles in which issues of medicine are discussed.	203	0	13(6.4)	**121(59.6)**	69(34.0)	3.28	.574	-.088	-.502
4.	I routinely attend meetings of student study groups.	202	16(7.9)	**94(46.3)**	69(34.0)	23(11.3)	2.49	.800	.239	-.429
5.	I read medical literature in journals, websites or textbooks at least once every week.	203	28(13.8)	**82(40.4)**	68(33.5)	25(12.3)	2.44	.879	.108	-.671
6.	I routinely search computer databases to find out about new developments in science or medicine.	203	32(15.8)	**102(50.2)**	57(28.1)	12(5.9)	2.24	.787	.282	-.256
7.	I believe that I would fall behind if I stopped learning about new developments in medicine.	202	3(1.5)	24(11.8)	**120(59.1)**	55(27.1)	3.12	.661	-.452	.486
8.	One of the important goals of medical school is to develop students' life-long learning skills.	203	0	3(1.5)	63(31.0)	**137(67.5)**	3.66	.505	-1.026	-.181
9.	Rapid changes in medical science require constant updating of knowledge and development of new professional skills.	203	0	2(1.0)	67(33.0)	**134(66.0)**	3.65	.498	-.876	-.663
10.	I always make time for learning on my own, even	203	4(2.0)	58(28.6)	**89(43.8)**	52(25.6)	2.93	.787	-.124	-.821

	when I have a busy class schedule and other obligations.									
11.	I recognize my need to constantly acquire new professional knowledge.	203	0	4(2.0)	**105(51.7)**	94(46.3)	3.44	.536	-.161	-1.168
12.	I routinely attend optional sessions such as study groups, guest lectures, or exposure to healthcare experience where I can volunteer to improve my knowledge and experience.	203	1(0.5)	41(20.2)	**116(57.1)**	45(22.2)	3.01	.667	-.112	-.418
13.	I take every opportunity to gain new knowledge/skills that are important to my profession.	203	0	39(19.2)	**115(56.7)**	49(24.1)	3.05	.658	-.052	-.673
14.	My preferred approach in finding an answer to a question is to search the appropriate computer database.	203	9(4.4)	52(25.6)	**110(54.2)**	32(15.8)	2.81	.748	-.326	-.047

Note: Bolded values indicate the most selected response option.

Table 7

Academic Emotion Regulation Questionnaire Response Frequencies and Descriptive Statistics

		N	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean	Standard Deviation	Skewness	Kurtosis
1.	When I am very nervous about an exam, I decide to skip classes that day.	203	**85(41.9)**	84(41.4)	29(14.3)	5(2.5)	1.77	.782	.735	-.059
2.	When going to school is stressful for me, I stay at home.	203	86(42.4)	**89(43.8)**	25(12.3)	3(1.5)	1.73	.732	.701	-.021
3.	When I am afraid of an oral exam, I stay at home that day.	203	**112(55.2)**	87(42.9)	3(1.5)	1(0.5)	1.47	.557	.803	.641
4.	When I feel too much pressure from school obligations, I 'get sick' for a couple of days.	202	**121(59.6)**	68(33.5)	11(5.4)	2(1.0)	1.48	.648	1.257	1.378
5.	Good organization of time for studying and fun reduces my tension.	203	0	9(4.4)	**109(53.7)**	85(41.9)	3.37	.570	-.224	-.755
6.	Through investing additional effort in learning, I reduce shame due to failure at school.	203	3(1.5)	21(10.3)	**137(67.5)**	42(20.7)	3.07	.605	-.440	1.312
7.	When I feel insecure in my knowledge, I revise the material additionally.	201	2(1.0)	21(10.3)	**125(61.6)**	53(26.1)	3.14	.625	-.356	.550
8.	If the amount of learning material scares me, I carefully organize my schedule of studying.	203	6(3.0)	29(14.3)	**115(56.7)**	53(26.1)	3.06	.722	-.567	.444
9.	My thoughts stray to more pleasant matters when I feel frustrated by studying.	203	18(8.9)	**90(44.3)**	79(38.9)	16(7.9)	2.46	.766	.075	-.335
10.	I start to think about something more fun when studying becomes boring to me.	203	14(6.9)	60(29.6)	**108(53.2)**	21(10.3)	2.67	.754	-.349	-.082

11. When I get bored by the lesson, I put my mind on something interesting.	203	8(3.9)	74(36.5)	**104(51.2)**	17(8.4)	2.64	.692	-.108	-.151
12. When I get frustrated by the teacher, I try to think about something that brings me joy.	203	16(7.9)	**109(53.7)**	74(23.5)	4(2.0)	2.33	.647	.010	-.210
13. When I am bored in school, I have fun with something else (I draw, chat with a friend, etc).	203	25(12.3)	78(38.4)	**85(41.9)**	15(7.4)	2.44	.803	-.104	-.491
14. When I feel anxious in classes, I 'shut myself down' and think of something else.	203	40(19.7)	78(38.4)	**85(41.9)**	15(7.4)	2.08	.723	.269	-.138
15. When I am afraid of an exam/test, I tell myself that there is always a second chance.	203	39(19.2)	**96(47.3)**	52(25.6)	16(7.9)	2.22	.847	.348	-.411
16. When I feel bad about failing an exam, I tell myself that it is not so important to be the best.	203	36(17.7)	**83(40.9)**	64(31.5)	20(9.9)	2.33	.882	.163	-.674
17. I reduce exam tension by reminding myself that there are more important things in life.	202	20(9.9)	71(35.0)	**88(43.3)**	23(11.3)	2.56	.822	-.127	-.481
18. When I am ashamed of bad grades, I remind myself that grades don't always reflect real knowledge.	203	22(10.8)	70(34.5)	**91(44.8)**	20(9.9)	2.54	.816	-.175	-.463
19. If I'm sad because of poor grades, I comfort myself with the thought that study is not the most important thing in life.	202	19(9.4)	**87(42.9)**	75(36.9)	21(10.3)	2.49	.806	.106	-.452
20. I try to suppress the anger and rage I feel in class.	199	48(23.6)	58(28.6)	**70(34.5)**	23(11.3)	2.34	.971	.037	-1.037
21. I try to hide the anger I feel towards the teacher.	200	55(27.1)	51(25.1)	**70(34.5)**	24(11.8)	2.32	1.005	.053	-1.151
22. I do not want others to see how disappointed I feel about my failures.	202	10(4.9)	45(22.2)	**104(51.2)**	43(21.2)	2.89	.791	-.414	-.140

23. When I feel bad because of the teacher's comments, I do not want others to see that.	203	12(5.9)	42(20.7)	**114(56.2)**	35(17.2)	2.85	.772	-.513	.167
24. I try not to show how I angry I am when the teacher is not fair.	203	21(10.3)	65(32.0)	**99(48.8)**	18(8.9)	2.56	.796	-.293	-.351
25. I breathe deeply in order to reduce the tension that I feel in exam situations.	203	7(3.4)	30(14.8)	**115(56.7)**	51(25.1)	3.03	.734	-.585	.449
26. When I do a test paper, I breathe deeply to calm down.	202	8(3.9)	36(17.7)	**112(55.2)**	46(22.7)	2.97	.753	-.517	.219
27. When I become enraged because of a difficult task that I have to resolve, I take a couple of deep breaths.	202	11(5.4)	25(12.3)	**135(66.5)**	31(15.3)	2.92	.701	-.853	1.411
28. When I become very angry in school, I vent my rage on others.	203	**74(36.5)**	71(35.0)	49(24.1)	9(4.4)	1.97	.887	.455	-.778
29. I yell at someone when I become anxious in school.	203	**140(69.0)**	50(24.6)	13(6.4)	0	1.37	.603	1.382	.848
30. When I'm nervous about some exam, I talk about it with someone who is close to me.	203	7(3.4)	14(6.9)	**116(57.1)**	66(32.5)	3.19	.707	-.878	1.391
31. When school demands frustrate me, I share my troubles with friends.	203	6(3.0)	22(10.8)	**119(58.6)**	56(27.6)	3.11	.702	-.673	.880
32. When I feel miserable due to my poor grades, I pour out my troubles to someone.	203	20(9.9)	55(27.1)	**91(44.8)**	56(27.6)	2.71	.877	-.297	-.558
33. When I feel bad due to failure at school, I talk about it with my friends.	203	18(8.9)	33(16.3)	**116(57.1)**	36(17.7)	2.84	.819	-.672	.204
34. Browsing through the answers in my head helps me to reduce the pressure in exam situations.	203	5(2.5)	28(13.8)	**148(72.9)**	22(10.8)	2.92	.583	-.747	2.155
35. When I become furious because of studying and tasks, I start to throw things around the room.	203	**168(82.8)**	32(15.8)	3(1.5)	0	1.19	.427	2.175	4.077

36.	When I fail in school, I kick or punch the first thing in the way.	203	**169(83.8)**	31(15.3)	3(1.5)		0	1.18	.424	2.232	4.364
37.	When I become very upset in school, I start to yell at people around me.	203	**160(78.8)**	33(16.3)	10(4.9)		0	1.26	.541	1.989	3.020

Note: Bolded values indicate the most selected response option.

Table 8

Goal Orientation Scale Response Frequencies and Descriptive Statistics

		N	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean	Standard Deviation	Skewness	Kurtosis
1.	I am willing to select a challenging work assignment that I can learn a lot from.	202	0	6(3.0)	**125(61.6)**	71(35.0)	3.32	.528	.141	-.762
2.	I often look for opportunities to develop new skills and knowledge.	203	0	5(2.5)	**118(58.1)**	80(39.4)	3.37	.533	.042	-.989
3.	I enjoy challenging and difficult tasks at work.	203	0	12(5.9)	**132(65.0)**	59(29.1)	3.23	.546	.084	-.249
4.	For me, development of my work ability is important enough to take risks.	202	0	20(9.9)	**131(64.5)**	51(25.1)	3.15	.574	-.006	-.135
5.	I prefer to work in situations that require a high level of ability and talent.	203	0	14(6.9)	**120(59.1)**	69(34.0)	3.27	.581	-.112	-.502
6.	I'm concerned with showing that I can perform better than my coworkers.	203	22(10.8)	**97(47.8)**	70(34.5)	14(6.9)	2.37	.769	.166	-.295
7.	I try to figure out what it takes to prove my ability to others at work.	203	11(5.4)	74(36.5)	**100(49.3)**	18(8.9)	2.62	.724	-.135	-.197
8.	I enjoy it when others at work are	203	11(5.4)	49(24.1)	**120(59.1)**	23(11.3)	2.76	.720	-.497	.322

	aware of how well I am doing.									
9.	I prefer to work on projects where I can prove my ability to others.	203	9(4.4)	79(38.9)	**105(51.7)**	10(4.9)	2.57	.659	-.214	-.111
10.	I would avoid taking a new task if there was a chance that I would appear rather incompetent to others.	203	21(10.3)	**98(48.3)**	78(38.4)	6(3.0)	2.34	.702	-.065	-.328
11.	Avoiding a show of low ability is more important to me than learning a new skill.	203	60(29.6)	**120(59.1)**	20(9.9)	3(1.5)	1.83	.654	.507	.651
12.	I'm concerned about taking on a task at work if my performance would reveal that I have low ability.	202	28(13.8)	**92(45.3)**	77(37.9)	5(2.5)	2.29	.732	-.134	-.538
13.	I prefer to avoid situations at work where I might perform poorly.	203	21(10.3)	79(38.9)	**101(49.8)**	2(1.0)	2.41	.687	-.565	-.503

Note: Bolded values indicate the most selected response option.

Table 9

Academic Self-Concept Scale Response Frequencies and Descriptive Statistics

	N	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean	Standard Deviation	Skewness	Kurtosis
1. I can follow the lessons easily.	203	32(15.8)	**98(48.3)**	62(30.5)	11(5.4)	2.26	.786	.194	-.357
2. I day-dream a lot in class.	203	13(6.4)	**149(73.4)**	37(18.2)	4(2.0)	2.16	.549	.796	1.892
3. I am able to help my classmates in their schoolwork.	202	42(20.7)	**126(62.1)**	34(16.7)	0	1.96	.614	.022	-.318
4. I often do my homework without thinking.	203	**99(48.8)**	**99(48.8)**	5(2.5)	0	1.54	.547	.310	-1.014
5. If I work hard, I think I can match well for residency.	203	2(1.0)	23(11.3)	**131(64.5)**	47(23.2)	3.10	.614	-.318	.675
6. I pay attention to the teachers during lessons.	202	11(5.4)	86(42.4)	**96(47.3)**	9(4.4)	2.51	.671	-.136	-.189
7. Most of my classmates are smarter than I am.	199	19(9.4)	72(35.5)	**99(48.8)**	9(4.4)	2.49	.731	-.366	-.279
8. I study hard for my tests.	203	0	9(4.4)	92(45.3)	**102(50.2)**	3.46	.582	-.521	-.664
9. My teachers feel that I am poor in my work.	202	0	0	**134(66.0)**	68(33.5)	3.34	.474	.697	-1.530
10. I am usually interested in my schoolwork.	203	2(1.0)	7(3.4)	**145(71.4)**	49(24.1)	3.19	.531	-.243	2.179
11. I often forget what I have learned.	203	9(4.4)	61(30.0)	**113(55.7)**	20(9.9)	2.71	.703	-.301	.056
12. I will do my best to pass all subjects.	203	0	1(0.5)	40(19.7)	**162(79.8)**	3.79	.418	-1.661	1.371
13. I often feel like quitting school.	203	3(1.5)	11(5.4)	76(37.4)	**113(55.7)**	3.47	.670	-1.199	1.429
14. I am good in most of my school subjects.	202	0	18(8.9)	**148(72.9)**	36(17.7)	3.09	.511	.145	.735
15. I am always waiting for the lesson to end.	202	5(2.5)	78(38.4)	**108(53.2)**	11(5.4)	2.62	.629	-.095	-.170
16. I always do poorly on tests.	201	0	6(3.0)	**110(54.2)**	85(41.9)	3.39	.547	-.120	-.938
17. I do not give up easily when I am faced with a	202	2(1.0)	6(3.0)	**112(55.2)**	82(40.4)	3.36	.592	-.591	1.051

	difficult question in my schoolwork.									
18.	I am able to do better than my friends in most subjects.	202	3(1.5)	83(40.9)	**104(51.2)**	12(5.9)	2.62	.622	.104	-.344
19.	I am not willing to put more effort in my schoolwork.	203	1(0.5)	9(4.4)	88(43.3)	**105(51.7)**	3.46	.607	-.795	.362

Note: Bolded values indicate the most selected response option.

Overall, students tended to agree or strongly agree with most of the survey items provided. Items with greater disagreement tended to be behavioral in nature: students responding about additional learning tasks or emotion regulation behaviors. Only ten of the 83 total items have a mean score less than two and most of these items are from the AERQ, where students were responding to items about responses to negative emotions. These descriptive statistics indicate that several items do not meet the assumption of normality because of skewness or kurtosis values greater than ±2. As such, items 2 and 10 from the Academic Self-Concept Scale and items 5, 30, 32, and 33 from the Academic Emotion Regulation Questionnaire were removed. While the non-normal AERQ items were not included in any additional analyses, the ASCS items were maintained for the validation components of the study. While ASCS item 2 is not outside the ±2 threshold, it is close (Kurtosis= 1.892), and visual analysis of the histogram indicated a lack of normality. Multicollinearity was analyzed using a correlation table of all items; no items had a correlation of 0.9 or higher, indicating that the assumption of multicollinearity was met. Bartlett's test of sphericity was significant ($\chi 2$ (2628) = 7064.147, $p <$ .00), indicating that the correlation matrix was not an identity matrix, maintaining the assumption of sphericity.

Outcomes. Table 10 presents descriptive statistics about students' grade outcomes. The data are normally distributed and outlying cases were removed as described above. As would be expected from high-achieving students, the grades are all high. Students' lowest average grade falls in the B range and comes from their first exam in medical school, which could explain the lower performance as students were adapting to and learning the expectations of this new environment.

Table 10

Grade Outcome Descriptive Statistics

	N	Mean	Standard Deviation	Skewness	Kurtosis
Molecular Basis of Health and Disease Course Grade (MBHD)	203	85.8608	5.78090	-.802	.450
Practice of Clinical Medicine Objective Structured Clinical Examination Grade (PCM OSCE)	200	91.2608	4.36782	-.842	.657
Foundations of Disease Course Grade (FoD)	198	90.2876	4.12366	-.689	.830
Practice of Clinical Medicine Course Grade (PCM Grade)	200	89.6974	2.81958	-.788	1.142

Academic Self-Concept Scale Validation

Evidence based on test content. As mentioned in Chapter Three, much of the test content validity for the ASCS was established by the original authors. However, as one item (Item 5) was altered to better fit the medical school context, it was important to examine this item closely. Responses to this question were obtained from the entire sample, with a large majority in agreement that through hard work, they could match well for residency. Data for this item falls in the acceptable range for skewness and kurtosis, so it can be considered normal. Given this information, it was decided that this item was an appropriate indicator of the construct and it was included in further analyses. Additionally, items were compared to another widely used measure of ASC to build evidence for the overall ASCS content as an indicator of students' ASCs (See Table 5 in Chapter Three, p. 46).

Evidence based on internal structure. The first step in validating the ASCS for a medical student population was to run a CFA. Given the original factor structure, analyses

attempted to fit data to a Confidence factor, an Effort factor, and a single ASC factor. None of the three factors tested were a good fit: Confidence (χ^2: $p < 0.000$, CFI: 0.501, TLI: 0.335, RMSEA: 0.139), Effort (χ^2: $p < 0.000$, CFI: 0.901, TLI: 0.873, RMSEA: 0.058), and ASC (χ^2: $p < 0.000$, CFI: 0.646, TLI: 0.602, RMSEA: 0.086). The Effort factor appears to be approaching fit, but this factor structure does not fit for this size sample. Given the lack of fit of the specified three factors, an EFA was performed to examine the factor structure emerging for this sample.

Due to their lack of normality for this sample, items 2 and 10 were removed from the ASCS scale moving forward. An EFA using promax rotation to allow factors to correlate was performed on the remaining 17 items. A promax rotation was selected because of the use of both subscales as a single scale by the authors. Five factors with eigenvalues greater than one were extracted. The initial factor structure is included in Appendix A. This solution resulted in item six ("I pay attention to the teachers during lessons") being the sole item to load onto factor four and a two-item loading for factor 5 ("I am able to help my classmates in their schoolwork" and "My teachers feel that I am poor in my work"). Because these items were not interpretable as factors, a follow-up analysis was performed to restrict the number of factors to four and load these items with others. The four-factor solution (Appendix B) had more consistent loadings except for the same two-item factor from the five-factor model. The decision was made to test a three-factor structure to produce factors that were interpretable.

The three-factor solution (Table 11) produced three interpretable factors with the appropriate numbers of items for further analysis. Factor 1 represents students' confidence, and except for ASCS item four ("I often do my homework without thinking"), these items are the same as the items in the original scale's confidence subscale. Item four was included with this subscale because its higher loading suggests that students may have interpreted it to mean that

homework can be done easily because of their ability. Given that this item reduced the reliability of both Factor 1 and Factor 2 if included, these students seem to be interpreting it differently than students in the original sample did. Initial reliability for these items, in the form of McDonald's Omega, is 0.667, but with the removal of item four, the reliability increases to 0.761, an acceptable level of reliability for a scale. Given this reliability and the similarity to original items, Factor 1 was labeled the Confidence subscale (e.g. "I am good in most of my school subjects"). Factor 2 represented students' perceptions of their effort, and except for ASCS item three ("I am able to help my classmates in their schoolwork"), all the items loaded onto this factor also loaded on to the original scale's effort subscale. The preliminary reliability of these items was 0.459, but when items three and eight ("I study hard for my tests") were removed, scale reliability increased to 0.657. While these items do appear to begin to capture information about medical students' effort perceptions, the low alpha value makes the use of these items as a subscale inappropriate. Finally, the items that loaded onto Factor 3 represent students' persistence at academic tasks, which appears to be a more affective element than their effort perceptions. ASCS item 17 was included with Factor 3 instead of Factor 2 because its wording suggests a level of personal evaluation ("I do not give up easily…") that is different than task evaluation. Similarly, ASCS item 13 was included with Factor 3 and not Factor 1 because school success is not only predicted by confidence, but also by students' affective engagement with their school. Preliminary reliability estimates for these items was 0.130, but with the removal of item one and item five, reliability increased to 0.573. As with the second factor, this represents some information about students' affect in academic situations, but the low reliability indicates they are not appropriate to use in this context.

Table 11

Three-Factor Academic Self Concept Scale Exploratory Factor Analysis

	Factor 1	Factor 2	Factor 3
1. I am able to do better than my friends in most subjects.	**0.815**	-0.1245	-0.2342
2. Most of my classmates are smarter than I am.	**0.7985**	-0.2715	-0.0239
3. I am good in most of my school subjects.	**0.6673**	0.1633	-0.1963
4. I always do poorly on tests.	**0.5982**	0.1453	0.0774
5. I often forget what I have learned.	**0.587**	-0.0143	0.2257
6. My teachers feel that I am poor in my work.	**0.4852**	0.1173	0.158
7. I often do my homework without thinking.	**-0.3968**	*-0.3563*	0.0295
8. I will do my best to pass all subjects.	-0.0313	**0.7539**	0.1185
9. I am not willing to put more effort in my schoolwork.	-0.0683	**0.7282**	0.0327
10. I study hard for my tests.	-0.1153	**0.722**	0.0709
11. I pay attention to the teachers during lessons.	-0.1304	**0.2716**	-0.1616
12. I am able to help my classmates in their schoolwork.	0.031	**-0.2646**	0.0476
13. I can follow the lessons easily.	0.1443	-0.0702	**-0.7706**
14. If I work hard, I think I can match well for residency.	-0.1605	0.148	**0.7137**
15. I am always waiting for the lesson to end.	0.1425	0.1301	**0.5887**
16. I do not give up easily when I am faced with a difficult question in my schoolwork.	0.0889	*0.3782*	**-0.5788**
17. I often feel like quitting school.	*0.3366*	0.1722	**0.4233**

Note: Bolded values indicate the highest factor loading. Italicized values indicate a significant cross-loading.

As such, the Confidence subscale is the only subscale for which validity evidence based on internal structure exists for medical students in this sample. This finding is not altogether unexpected given that the core of ASC is students' competence beliefs. However, the qualitative findings from medical students suggest the value of effort to this population and indicates that further work is necessary to understand the nature of medical students' effort beliefs in relation to their competence beliefs. At the same time the difference in context between the population the ASCS was built with and the one it is currently being tested with cannot be ignored, which is further reason to engage in more thorough research of student perspectives. The presence of some items cross-loading significantly on multiple factors also indicates that these items are functioning different for this sample than for the one the scale was developed with. Reliability results for the original sample were $\alpha = 0.82$, $\alpha = 0.71$, and 0.76 for the whole scale, confidence,

and effort subscales respectively. The omega results of this study appear to be approaching a similar level of reliability, but differences in context and reliability measure prevent direct comparisons. Of note is that the least reliable new subscale created is distinct from the two that align with the original subscales and merits further study.

Evidence based on relationships to other variables. To build validity evidence based on relationships to other variables, mean subscale scores were calculated. Due to the removal of non-normal items, the AERQ subscale venting was left with only two items and was not used for further analyses. ASC is only represented by the Confidence subscale, while the remainder of the subscales included are Lifelong Learning (LL), Goal orientation (Learning, LO; Prove, PO; Avoid, AO), and Academic Emotion Regulation (Situation Selection, SiSe; Developing Competencies, DC; Redirecting Attention, RA; Reappraisal, Ra; Suppression, S; Respiration, Re; Social Support, SoSu). To test for relationships between ASC and these other variables, a correlation table (Table 12) was produced. Table 13 shows correlations between students' grade outcomes and ASC. Key findings are that ASC is correlated in ways mostly consistent with the literature regarding other administered surveys, but the lack of significant relationships to grade outcomes is different to what was expected based on the literature.

Table 12

Mean Scale Score Correlations for Academic Self Concept Scale Validation

	ASC	LL	LO	PO	AO	SiSe	DC	RA	Ra	S	Re	SoSu
ASC	1	.229**	.425**	0.023	-.267**	-.279**	-0.033	-.164*	-0.100	-.241**	0.007	-.287**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 13

Correlations Between Student Grade Outcomes and Academic Self-Concept

	ASC	MBHD	PCM OSCE	FoD	PCM Grade
ASC	1	.026	-.089	-.045	-.043
MBHD	.026	1	.133	.484**	.388**
PCM OSCE	-.089	.133	1	.168*	.604**
FoD	-.045	.484**	.168*	1	.396**
PCM Grade	-.043	.388**	.604**	.396**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Overall validity evidence. Overall validity evidence for the ASCS in this sample of medical students is mixed. The Confidence subscale provides reliable information about students' academic confidence, and the relationships between ASC, Lifelong Learning, Learning Goal Orientation, and Avoid Goal Orientation present as expected based on the literature. The lack of correlations between ASC and students' academic outcomes are different to expectations outlined in the literature, as are negative correlations with competency development and reappraisal regulatory strategies. Given the exploratory nature of this study and the presence of some evidence for validity, the ASC scale was included in the next stage of the research: the development of a MAL scale.

Master Adaptive Learner Scale Construction

Given the lack of a unified scale to measure MAL, the first step in the dimension reduction process to create a reduced scale was to examine each of the subscales to be included based on reliability and to remove items that lower the reliability of these subscales. The Lifelong Learning scale produced an omega value of 0.775, but the removal of items four and seven increased the reliability to 0.803. Two items were removed from the Learning Orientation

Subscale to improve the initial reliability from 0.604 to 0.790; one item was removed from the Avoidance Orientation subscale (final Ω= 0.739); and one item was removed from the Performance Orientation (final Ω= 0.774). Regarding the AERQ, no items were removed from the Social Support subscale (Ω= 0.851); one item was removed from the Redirecting Attention scale (final Ω = 0.746) and the Situation Selection subscale (final Ω= 0.848); two items were removed from the Reappraisal subscale (final Ω= 0.726); and finally, the Developing Competencies, Suppression, and Respiration subscales produced low reliability scores and no item removal brought these scales above the 0.70 threshold, so they were excluded from further analyses to ensure quality inferences could be made. Fourteen factors were initially extracted based on eigenvalues greater than one, but a scree plot suggested that a six-factor solution might be a better fit. Figure 4 shows the scree plot used to make this decision. The six factors that emerged are included in Table 14.

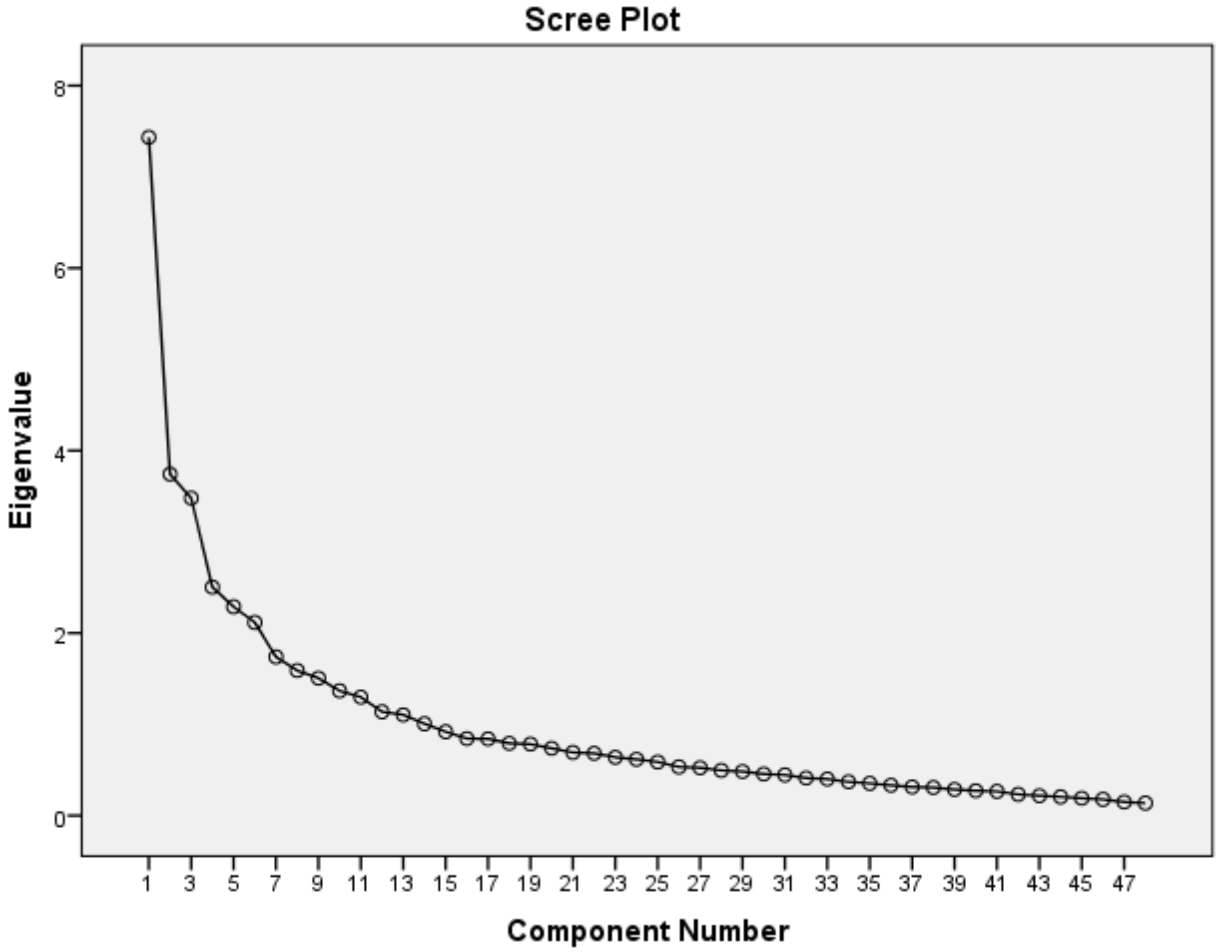

Figure 4. Scree Plot of Master Adaptive Learner Scale Items.

Table 14

Six Factor Structure of Master Adaptive Learner Scale

		1	2	3	4	5	6
1.	I enjoy challenging and difficult tasks at work.	**.686**	-.017	.075	-.086	-.114	-.049
2.	I prefer to avoid situations at work where I might perform poorly.	**-.657**	.078	-.058	-.059	-.029	.213
3.	I would avoid taking a new task if there was a chance that I would appear rather incompetent to others.	**-.621**	.076	-.051	-.097	.059	.031
4.	I prefer to work in situations that require a high level of ability and talent.	**.602**	.151	.052	-.030	.039	.086
5.	I often look for opportunities to develop new skills and knowledge.	**.559**	.086	.166	.044	-.058	-.046
6.	Avoiding a show of low ability is more important to me than learning a new skill.	**-.554**	-.191	-.020	-.105	.050	.238
7.	I am able to do better than my friends in most subjects.	**.465**	.117	-.062	-.211	.114	*.335*
8.	I often forget what I have learned.	**.428**	.144	.141	-.078	-.142	.196
9.	I am always waiting for the lesson to end.	**.401**	.136	.023	.174	-*.378*	-.084
10.	Most of my classmates are smarter than I am.	**.374**	.079	-.178	-*.373*	-.062	.298
11.	When going to school is stressful for me, I stay at home.	-.079	**-.734**	.157	.000	.144	-.039
12.	When I am afraid of an oral exam, I stay at home that day.	-.001	**-.709**	.137	.114	.048	.005
13.	When I am very nervous about an exam, I decide to skip classes that day.	.022	**-.663**	.238	.023	.075	-.061
14.	I will do my best to pass all subjects.	.014	**.556**	.194	.111	-.031	-.064
15.	I always do poorly on tests.	.212	**.476**	-.038	-.164	.198	.122

16. Rapid changes in medical science require constant updating of knowledge and development of new professional skills.	-.198	**.467**	*.363*	.002	.098	-.173
17. I am not willing to put more effort in my schoolwork.	.050	**.466**	.074	.052	-.057	-.088
18. I often feel like quitting school.	.251	**.426**	.027	.060	-.027	.047
19. Life-long learning is a professional responsibility of all physicians.	-.103	**.409**	*.385*	.055	.030	-.116
20. My teachers feel that I am poor in my work.	.226	**.405**	-.123	-.061	.044	.033
21. I study hard for my tests.	-.064	**.383**	.228	.109	-.156	.030
22. One of the important goals of medical school is to develop students' life-long learning skills.	-.095	**.375**	*.365*	.038	.274	-.173
23. I am good in most of my school subjects.	.299	**.340**	.141	-.169	*.312*	.224
24. I read medical literature in journals, websites or textbooks at least once every week.	.174	-.175	**.681**	.021	-.127	.183
25. I routinely search computer databases to find out about new developments in science or medicine.	.135	-.220	**.645**	-.122	-.053	.041
26. I enjoy reading articles in which issues of medicine are discussed.	.191	.060	**.602**	.063	-.104	.126
27. My preferred approach in finding an answer to a question is to search the appropriate compute database.	-.184	-.022	**.575**	-.068	.135	.086
28. I take every opportunity to gain new knowledge/skills that are important to my profession.	.086	.070	**.568**	.009	.122	.026
29. I always make time for learning on my own, even when I have a busy class schedule and other obligations.	.129	-.166	**.541**	-.121	-.104	-.061
30. Searching for the answer to a question is, in and by itself rewarding.	*.314*	-.198	**.491**	-.252	-.115	-.050

31. I recognize my need to constantly acquire new professional knowledge.	.070	.263	**.459**	.033	.009	-.114
32. I routinely attend optional sessions such as study groups, guest lectures, or exposure to healthcare experience where I can volunteer to improve my knowledge and experience.	.021	.182	**.371**	.072	.128	.031
33. When school demands frustrate me, I share my troubles with friends.	.086	-.040	-.023	**.872**	-.132	.228
34. When I feel bad due to failure at school, I talk about it with my friends.	.080	.015	-.043	**.830**	.001	.246
35. When I'm nervous about some exam, I talk about it with someone who is close to me.	-.013	.038	-.073	**.820**	-.126	.122
36. When I feel miserable due to my poor grades, I pour out my troubles to someone.	-.135	.026	-.057	**.815**	-.035	.289
37. When I get bored by the lesson, I put my mind on something interesting.	-.112	.043	-.085	-.146	**.752**	.024
38. I start to think about something more fun when studying becomes boring to me.	-.080	.068	-.118	-.076	**.708**	.065
39. My thoughts stray to more pleasant matters when I feel frustrated by studying.	-.123	.006	.063	-.142	**.683**	.112
40. When I get frustrated by the teacher, I try to think about something that brings me joy.	-.013	-.230	.270	-.008	**.503**	.151
41. When I am bored in school, I have fun with something else (I draw, chat with a friend, etc).	-.083	-.210	.224	.060	**.448**	.258
42. When I feel bad about failing an exam, I tell myself that it is not so important to be the best.	*.375*	-.092	-.279	.304	**.408**	-.235
43. When I am ashamed of bad grades, I remind myself that grades don't always reflect real knowledge.	*.313*	-.150	-.034	.246	**.401**	-.288

44. When I am afraid of an exam/test, I tell myself that there is always a second chance.	.219	-.107	-.004	*.351*	**.381**	-.079
45. If I work hard, I think I can match well for residency.	-.012	.270	.122	*.264*	**-.277**	-.028
46. I prefer to work on projects where I can prove my ability to others.	-.012	-.066	.105	.190	.068	**.801**
47. I enjoy it when others at work are aware of how well I am doing.	-.154	.115	.045	*.328*	.073	**.752**
48. I try to figure out what it takes to prove my ability to others at work.	.013	-.080	-.005	.280	.151	**.724**

Note: Bolded values indicate the highest factor loading. Italicized values indicate a significant cross-loading.

These six factors emerge clearly and are in interpretable groups. Items on Factor 1 came from the goal orientation and ASC scales. Significant cross-loading occurred with items 7, 9, and 10. Item 7 was included on this factor because it represents confidence and did not reflect the prove orientation captured by Factor 6, nor did it improve the reliability of that factor. Item 9 was included with this factor because it did not represent an emotion regulation strategy as the other items on Factor 5 did. Item 10 was included here because while it was a social-oriented item, it was related to students' confidence and not social support as the remainder of the items on Factor 4 were. Initial reliability estimates produced an omega value of 0.696. When MAL items 9 ("I am always waiting for the lesson to end") and 10 ("Most of my classmates are smarter than I am") were removed, scale reliability improved to 0.723. The combination of mastery items and negatively loading performance with confidence items from the ASCS led to this factor being labeled "Mastery." Items on Factor 2 came from the Lifelong Learning, ASC, and Academic Emotion Regulation scales. Significant cross-loading occurred with items 16, 19, 22, and 23. Items 16, 19, and 22 all come from the Lifelong Learning scale, but are included on Factor 2 because unlike Factor 3, they do not represent behavior, but instead attitudes about what it means to be a learner that align with other attitudinal effort items on Factor 2. Item 23 is included because it is not an emotion regulation strategy. Initial reliability was 0.395, but the removal of eight items from the ASCS and Lifelong Learning scales improved the reliability to 0.797. The negative loading of the avoidance items and other items representing approaching situations led this factor to be labeled "Effort." It is important to note that both Factor 1 and Factor 2 have negatively loaded items as the decision was made to not recode these scales that were designed to stand and be interpreted alone. In these cases, a lower score on the negatively loaded items is related to a more positive factor interpretation.

Initial reliability for Factor 3 was 0.590 containing items from the Lifelong Learning scale; with the removal of items 26, 31, and 32, the omega value increased to 0.727. There was significant cross-loading with item 30, "Searching for the answer to a question is, in and by itself rewarding," onto Factor 1. While this item does demonstrate some degree of a mastery orientation, the rest if the items on Factor 3 from the Lifelong Learning scale, and a more clear interpretation was for Factor 3 to be labeled "Lifelong Learning." Items scores on Factor 4 produced an initial reliability of 0.671, but with the removal of item 33 ("When school demands frustrate me, I share my troubles with friends") increased reliability to 0.738. Given that these items come from the Social Support subscale of the AERQ, this factor was labeled "Social Support."

Factor 5 contained items from the Redirecting Attention and Reappraisal subscales of the AERQ, as well as one item from the ASCS. Items 42 and 43 significantly cross-loaded onto Factor 1, while item 44 significantly cross-loaded onto Factor 4. Items 42 and 43 were left with Factor 5 because while they do represent some elements of what could be considered mastery, their specifically reference emotion regulation behaviors. Item 44 was kept with Factor 5 because it represents a reappraisal and does not reference social support at all. Initial reliability was 0.772 and reliability was not improved with the removal of any items, but the conceptually distinct ASCS item ("If I work hard, I think I can match well for residency") was removed due to its low, negative factor loading to maintain the conceptual consistency of the other items. Final reliability for Factor 5 was 0.740 and it was labeled "Attention." The final factor consisted of the three remaining items from the Performance Goal Orientation subscale. Item 47 significantly cross-loaded with Factor 4, but in the context of these items, 47 references social comparison and not social support. Reliability for this factor was 0.555 and no item removal improved the reliability

to above the 0.70 threshold, so this scale was not carried into further phases of analysis. Through dimension reduction and reliability analyses, the original 83 items collected were reduced to 30; this represents a nearly 65% decrease in the number of items from the original scales to the reduced versions. Scale scores were calculated for each of these factors which were then correlated with each other and with performance, as shown in Table 15.

Table 15

Correlations Between Master Adaptive Learner Subscale Scores and Performance

	FoD	MBHD	PCM Grade	PCM OSCE	Mastery	Effort	Lifelong Learning	Social Support	Attention
FoD	1	.484**	.396**	.168*	.015	.096	.160*	-.103	.023
MBHD	.484**	1	.388**	.133	.041	.105	.214**	-.153*	.068
PCM Grade	.396**	.388**	1	.604**	-.045	.100	.130	-.105	.025
PCM OSCE	.168*	.133	.604**	1	.010	.041	-.028	-.044	-.005
Mastery	.015	.041	-.045	.010	1	-.046	-.375**	.216**	-.134
Effort	.096	.105	.100	.041	-.046	1	-.047	.047	-.020
Lifelong Learning	.160*	.214**	.130	-.028	-.375**	-.047	1	-.508**	.420**
Social Support	-.103	-.153*	-.105	-.044	.216**	.047	-.508**	1	-.323**
Attention	.023	.068	.025	-.005	-.134	-.020	.420**	-.323**	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Given the purpose of creating a reduced scale to the overall concept of MAL, only factors that were significantly correlated at the 0.05 level were maintained. The only factor not correlated with any of the others was the "Effort" factor—all other factors were correlated with at least one other. As such, the "Effort" factor was removed, reducing the final pool of items to 25, an almost 70% decrease in total items. As part of this analysis, the factor scores were also correlated with students' performance indicators. While most MAL scales were not correlated with academic performance, there were weak positive relationships with lifelong learning and a

weak negative relationship with social support. A list of the final MAL scale items is included in Appendix F. These final 25 items capture core elements of the four instruments that were administered and represent students' orientations towards MAL. Table 16 presents scale scores and distributions for the 4 MAL subscales as well as the scores and distributions for the original scales for comparison.

Table 16

Scale Scores and Distributions for MAL Subscales and Original Scales

	Mean	Minimum	Maximum	Std. Deviation	Skewness	Kurtosis
MAL - Mastery	2.1890	1.00	3.38	.44471	-.075	-.101
MAL - Lifelong Learning	3.2255	2.33	4.00	.36627	.139	-.520
MAL - Social Support	2.1954	1.00	3.67	.55165	-.140	-.029
MAL - Attention	3.1404	2.13	4.00	.37643	.048	-.177
ASC - Confidence	2.9349	1.83	4.00	.40352	.010	-.341
LL - Lifelong Learning	3.1199	2.08	4.00	.35646	.092	-.071
GO - Learning Orientation	3.2906	2.00	4.00	.46237	.209	-.760
GO - Performance Orientation	2.6502	1.00	4.00	.57997	-.339	.343
GO - Avoid Orientation	2.1954	1.00	3.67	.55165	-.140	-.029
AERQ - Social Support	2.8867	1.00	4.00	.68840	-.377	.142
AERQ - Redirecting Attention	2.5074	1.00	3.80	.51713	-.294	-.034
AERQ - Reappraisal	2.3645	1.00	4.00	.68023	.049	.004
AERQ - Situation Selection	2.5074	1.00	3.80	.51713	-.294	-.034

Cluster analysis. After reducing the total item pool and developing a series of subscales to capture MAL, the next step was to see if different groups of students emerged based on responses to these factors. Cluster analysis allows data to be grouped so that observations in a group are like one another and dissimilar to observations in other groups. While FIML was an appropriate missing data technique for the CFA, the amount of missing data in the MAL items is even smaller. Only two of the values in these new factor scores were missing, so the decision was made to use multiple imputation to complete the data set and allow the assignment of all cases to their appropriate cluster. Using the complete data from the imputation, a hierarchical cluster analysis was performed using Ward's method to produce initial cluster groupings. A dendrogram was used to identify the number of clusters, which in this case was two. To confirm

these findings, a k-means cluster analysis was performed with two as the number of clusters. The results of this analysis placed 85 students into cluster one and 118 into cluster two. Table 17 shows the cluster centers and illustrates the differences between the two student groups while Table 18 presents descriptive statistics for each subscale based on group membership and Table 19 shows mean comparisons using an Independent Samples T-Test for each factor.

Table 17

Final Cluster Centers

	Cluster	
	1	2
Mastery	1.96	2.35
Lifelong Learning	3.49	3.03
Avoidance	1.76	2.51
Social Support	3.35	2.99

Table 18

Mean Master Adaptive Learner Subscale Scores for Clusters

	Cluster Number	Mean	Std. Deviation	Std. Error Mean
Mastery	1	1.9603	.41377	.04488
	2	2.3538	.39131	.03602
Lifelong Learning	1	3.4882	.29635	.03214
	2	3.0328	.28262	.02602
Social Support	1	1.7608	.42293	.04587
	2	2.5085	.40112	.03693
Attention	1	3.3529	.33584	.03643
	2	2.9873	.32743	.03014

Table 19

Independent Samples T-Test Comparing Clusters on Master Adaptive Learner Scale Scores

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mastery	Equal variances assumed	.714	.399	-6.901	201	.000	-.39352	.05703
	Equal variances not assumed			-6.838	174.962	.000	-.39352	.05755
Lifelong Learning	Equal variances assumed	.720	.397	11.099	201	.000	.45546	.04103
	Equal variances not assumed			11.014	175.912	.000	.45546	.04135
Social Support	Equal variances assumed	.352	.554	-12.807	201	.000	-.74769	.05838
	Equal variances not assumed			-12.697	175.288	.000	-.74769	.05889
Attention	Equal variances assumed	.363	.547	7.766	201	.000	.36565	.04709
	Equal variances not assumed			7.734	178.373	.000	.36565	.04728

Together, these results indicate that there is a statistically significant difference between students' factor scores for all factors. This suggests that students in cluster one are more mastery- and lifelong learning-oriented, more likely to shift attention or reappraise, and less likely to use social supports as an emotional regulation strategy in academic situations than students in cluster two. It is important to highlight that while the overall mean score on the mastery factor is lower for students in cluster one, they were still labeled as more mastery-focused because of the presence of negatively loading items. Students in cluster two have higher scores overall because they also respond to a greater degree to the avoidance-oriented items. Given that mastery, lifelong learning, and adaptive self-regulative strategies are elements of MAL, students in cluster one were labeled Master Adaptive Learners.

The final step in this study was to use the created clusters to compare performance on the selected grade outcomes between the two groups that emerged. While only some MAL items

were correlated with achievement in the whole sample, it was possible that there were different relationships for each of the subgroups that emerged. Mean scores are shown in Table 20 and the results of the T-test comparing the two groups is in Table 21.

Table 20

Mean Grade Outcomes for Clusters

	Cluster Number	Mean	Std. Deviation	Std. Error Mean
MBHD	1	87.0205	4.59074	.49794
	2	85.0254	6.39420	.58863
PCM OSCE	1	91.4371	4.56364	.49500
	2	91.1304	4.23275	.39471
PCM Grade	1	89.9300	2.80991	.30478
	2	89.5255	2.82662	.26358
FoD	1	90.6388	3.95442	.42892
	2	90.0235	4.24473	.39931
Mean Grade	1	89.7566	2.77615	.30112
	2	89.0483	3.14945	.29627

Table 21

Independent Samples T-Test Comparing Clusters on Grade Outcomes

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
MBHD	Equal variances assumed	8.846	.003	2.456	201	.015	1.99505	.81236
	Equal variances not assumed			2.588	200.999	.010	1.99505	.77099
PCM OSCE	Equal variances assumed	.239	.625	.490	198	.625	.30662	.62597
	Equal variances not assumed			.484	173.188	.629	.30662	.63310
PCM Grade	Equal variances assumed	.134	.715	1.003	198	.317	.40452	.40331
	Equal variances not assumed			1.004	181.734	.317	.40452	.40295
FoD	Equal variances assumed	.267	.606	1.040	196	.300	.61537	.59194
	Equal variances not assumed			1.050	187.226	.295	.61537	.58602
Mean Grade	Equal variances assumed	1.924	.167	1.647	196	.101	.70827	.43004
	Equal variances not assumed			1.677	191.065	.095	.70827	.42243

These results suggest that the MAL instrument can discriminate between students, and that these results are differentially predictive of students' performance on their first exam in medical school. While more research is necessary to explore the implications of these findings, the validity evidence provided for the ASCS and the reduction of scales for MAL expands our ability to understand medical students and their learning.

Chapter Five
Discussion

This final chapter serves to conclude this study with a discussion of the findings within the context of the study and a synthesis of the findings with the current bodies of literature in motivation, self-regulation, and medical education. While these findings are by no means an ending, this study serves as a platform for future research to be conceptualized and conducted. Limitations of this specific study are addressed and opportunities for further development and expansion are also explored.

Discussion of Major Findings

Given the design decisions made to answer the core research questions, two main branches of findings emerged: evidence around validity for the Academic Self-Concept Scale (ASCS; Liu et al., 2005) and measurement evidence for Master Adaptive Learning (MAL; Cutrer et al., 2017), each of which is discussed in detail below.

Academic Self-Concept Scale validity. The first research question, "Does the ASCS provide valid information about the ASCs of first-year medical students?" was answered using a series of quantitative methods to establish three main sources of validity evidence as outlined by *The Standards for Educational and Psychological Testing* (AERA et al., 2014). The need for these validation efforts came from an increased valuing for self-regulated learning (SRL) in the context of medical education paired with the need for a deeper understanding of motivational factors within the population of medical students (LCME, 2017; Swing, 2017). Students'

competence beliefs are important elements of their success (e.g. Marsh & Yeung, 1997), so academic self-concept (ASC) was selected as the first element of this exploration. To make meaningful and accurate inferences about our students, a scale to measure ASC was necessary.

Results of the validation of this scale were mixed. The items did not fit the factor structure outlined by the scale's creators (Liu et al., 2005), but factors did emerge. It was correlated to some, but not all, of the variables to which literature suggests ASC is linked (e.g. Arens, Yeung, Craven, & Hasselhorn, 2011; Jackman, Wilson, Seaton, & Craven, 2011). These points suggest that the ASCS brings us a few steps closer to measuring ASC in medical students, but that further work in capturing context and the needs of medical students is necessary. Medical students engage in learning in high pressure, high stakes environments that require them to actively process information and feedback to reach the best result; while this kind of learning is supported in the competency-based environment, a foundational level of knowledge about students' competence beliefs may enable educators to better encourage and support learning.

The results from the sample did not match the factor structure outlined by Liu and colleagues (2005), which contained scales for effort and confidence while also functioning as a single-factor scale for ASC. This result is not entirely unexpected, given the difference in samples to whom the survey was administered. While the items on the ASCS were developed in reference to several other ASC scales and the items are consistent with items on other scales intended for older populations, the developmental and educational gap between high school students and medical students is a large one. It is possible that the developmental differences in emotional and academic terms may have contributed to a differing understanding of the questions and responses between the two groups of students. Additionally, while the questions are not culturally specific, it is important to note that social and educational cultures in which

these students are situated are also very different. Singaporean high school students and American medical students are not likely to be confused, but the core of their experiences as learners connects them. Items in the ASCS were constructed with reference to a range of scales, and information from this scale can be used to drawn comparisons between a range of different learner populations. These potential developmental and cultural differences are one area where further work will be necessary. For example, cognitive interviewing during and after students' survey completion could be one way to clarify interpretational differences due to context.

The factors that did emerge were not far off from the original framework. The original scale broke out into factors for confidence and effort. The Confidence component is a core element of ASC measurement in all cases and the Effort component was the reason the ASCS was chosen for this study despite the differences in context between the two samples. As described in Chapter Two, the two qualitative studies about ASC in medical students reference students' effort beliefs (Jackman, Wilson, Seaton, & Craven, 2011; Yeung, Li, Wilson, & Craven, 2014). It was therefore important that measurement of this construct reference effort, and the results of this study indicate that effort is one component of medical students' ASCs. Reliability results from this study suggest that the scales are approaching reliability, if not beyond a useable threshold yet. Of note is that the least reliable new subscale created (Persistence) is distinct from the two that align with the original subscales and merits further study. Affect is an element of ASC (Arens et al., 2011), and Yamada and colleagues (2014) suggest that psychological distress and ASC are related in medical students, so better understanding with more detail as to why these items broke differently in medical students than in the original sample will be important.

The Effort factor represented what students do such as paying attention, studying, or putting effort into a task. The affective piece, which was here labeled "Persistence," reflected students' thoughts about their effort, such as envisioning futures built on hard work and staying with difficult tasks. Together, these two factors were composed of the same items that were in the ASCS effort scale, but there was something different about the students in this sample that caused the items to separate. These results highlight the importance of understanding context: Possible explanations for the different factor structures are that older, more developed students think differently about their academic emotions, or that the very nature of these effort perceptions is shaped by socio-educational contexts that surround students. This finding also suggests that attention should be paid to the characteristics of medical students that cause them to differ from other students. Given that neither one of the new subscales reached an acceptable level of reliability, the extent of the inferences that can be made here is limited. Understanding the experiences of medical students is important if we hope to produce the best doctors possible and doing so requires us to understand the emotional state of students and how they interact with their learning environment. Students' ability to adapt to diverse situations will depend on the effort they are willing to put into learning from ambiguous situations and taking chances, so these potential factors merit further study.

While the effort and persistence factors did not meet acceptable levels of reliability, the Confidence subscale did, and it aligned with the items in the ASCS scale. This was an encouraging finding as it helps to highlight a core element of medical students' ASCs: Across all the differences in context, students' beliefs in their abilities hold. In addition, this element of ASC was positively correlated with students' mastery orientations, lifelong learning, and emotion regulation. Based on the literature (Albert & Dahling, 2016; Fryer, 2015; Ommundsen,

Haugen, & Lund, 2005), we would expect these relationships to emerge, which lends one strong piece of evidence to the assumption that what is being captured here is students' ASC. On the other hand, the link between academic achievement and ASC is well-documented, and yet the results of this study do not suggest that students' responses to the Confidence subscale are related to their performance. While it still seems reasonable to call this ASC and to make limited inferences about students, more information is needed before high-stakes decisions should be made based on this information. Two main implications can be drawn from this lack of connection: 1) that students' ASCs change from medical school orientation to their first exam and/or 2) that additional confounding factors exist that influence the relationship in some way. This study has succeeded in its exploratory goals by laying a foundation for future research. Understanding on a deeper level the motivational and perceived competence development of medical students will extend our ability to measure ASC and use it to make meaningful changes in the student experience.

It is also worth noting that all the beliefs measured during students' orientation are contingent on their past academic experiences. This study was designed to be exploratory and to further our ability to understand ASC at the beginning of students' medical school careers, but it does not account for where those beliefs come from. Given that past experiences are the core of ASC and that patterns of ASC relationships in this study differ to those expected based on the literature, it is that much more important for us to understand the continuum of medical students' academic experiences. This study reveals that ASC is something that merits further study and understanding, and the lack of conclusive validity evidence is in and of itself a finding. If the ASCS does not provide valid information about medical students, is there a better tool? Does one need to be created from the ground up? Much of the ASC literature today stems from the work of

Shavelson and Marsh. Shavelson and colleagues (1976) helped lay the foundation for much of the present thinking on ASC, and Marsh (e.g. 1992) is responsible for some of the most widely used and validated measures of ASC across different ages. The SDQ III (Marsh, 1992) was built with the assistance of students providing feedback about important areas in their lives. Given that much has changed in terms of educational climate and measurement since these foundational works, it may be time to rethink what ASC is by including modern students' voices. Marsh and O'Neill (1984) highlight that in early attempts to validate the SDQ III, relationships between the different elements of students' self-concepts (including academics) were not as related as anticipated. Given the breadth of those items and the ones used in this study, perhaps students can help us to bring specificity into the measurement about what is most important to them. If we are trusting medical students with our health, we must have a deeper understanding of these students.

Master Adaptive Learner scale development. The other major finding of this study was that a range of motivational and self-regulative constructs could be combined into a single scale for the identification of MALs (Cutrer et al., 2017). This reduced scale is almost a quarter as long as the original pool of items making it a significantly more efficient measurement tool for the researcher and the student. The most significant finding here is that the newly developed instrument can discriminate between MALs and other types students. Results of the cluster analysis illustrate two statistically significant groups. Where MALs are higher in mastery, lifelong learning, and attention, and lower in social support, students in the other group are the opposite; these clusters mean that there are distinctions between students that may matter for future learning. The scales condensed in this study represent only a portion of what a MAL

might be, but finding some differences allows us to keep looking for others that might have more clinical or educational implications.

It is important to note here that the students are not being labeled as non-MALs or non-adaptive learners. Given the mastery and growth focus of MAL, it is inappropriate to focus on labeling students who do not currently exhibit this trait, but it is helpful to identify which traits mark MALs, so these traits can be encouraged in other students and vice versa. For example, skills from cluster 1 may help cluster 2 students take on greater mastery orientations, but skills from cluster 2 might encourage greater social support for emotions in cluster 1 students. Nonetheless, identification of MALs is important because it helps us to see what motivational or behavioral factors are adaptive. This distinction should then be used to highlight key areas and provide support to students who were not identified as MALs to develop competencies that will support their future mastery and adaptability developments. The focus should not be on whether someone is categorically not a MAL and should rather be on what can be done to make as many MALs as possible. Cutrer and colleagues (2017) end their paper by stating:

> We believe that working from a shared conceptual model will also allow for a robust and unified research agenda to guide deeper understanding of the interaction between the clinician, her skill as a learner, and the clinical working–learning environment (pp. 73-74)."

This statement summarizes why these clusters are important: they serve as guides for educators and researchers to support the development of medical students into the physicians we hope to see in practice.

It is interesting to note that except for the first exam, students' scores on the MAL scale were not related to their academic performance. At first impression, this lack of relationship was

troubling. Learning goals are related to performance (e.g. Brett & VandeWalle, 1999; Albert & Dahling, 2016), as are lifelong learning orientations (e.g. Fryer, 2015; Hojat et al., 2009). What use is there in being able to discriminate between groups of students if there is no difference in outcome? With further consideration, however, the role of academic performance may not be the only significant outcome when it comes to MAL. Learners who demonstrate a high MAL orientation are those who are willing to learn from mistakes, to take chances, and to incorporate novel information and experience into their learning (Cutrer et al., 2017). These behaviors may not be best reflected by grades. A more important question may be: How do MALs perform in the ambiguous clinical learning environment? This is an instance where it will be important for the field to define what is valued. Biesta (2009) calls for educators to grapple with the distinction between measuring what we value and valuing what we measure. This is particularly relevant in the current medical education climate; the field is moving towards competency development as a framework, but many of the valued outcomes are from tests. If producing MALs is to be a goal of medical education, there needs to be the recognition that we will need to assign greater value to outcomes that can help us detect this kind of learning. MAL's predictive power for students' first exam is an interesting finding. This suggests that students who enter medical school with certain traits may be better equipped to handle the transition into the higher expectations placed on them. While grades between the two groups stop diverging after that first exam, it is possible that there are other factors that stay at higher levels for MALs, or that the benefits gained by that easier transition carry across the rest of students' medical school experiences.

It is also worth noting what did not coalesce into the final scale. Much of the AERQ was not brought into the final scale for reliability reasons, and the created "Effort" factor was not correlated with any of the other elements considered to be part of MAL and was subsequently

dropped out; this is interesting because being able to self-regulate is an important element of the MAL framework. However, this was not the only place in these analyses where emotion was involved. As mentioned above, the affective elements of students' effort seemed to stick together for the ASCS. Students' responses to several items on the venting subscale of the AERQ were non-normal and a handful of students made comments on their physical surveys about confusion or non-agreement. Broadly, these responses suggest that understanding the emotional states of medical students may be valuable as we try to create curricula that are most supportive of their growth and development. Narrowly, in the context of this study, emotions may not be as related to students' mastery and competence beliefs as other, more concrete, SRL strategies. Future work will need to expand upon the behavioral components of MAL to highlight what regulatory strategies are most related to the developing definition of MAL and whatever outcomes are most valued by the field. Effort, on the other hand, was the reason the ASCS was selected for this study, so its lack of inclusion in the MAL scale is surprising. The factor contained items from lifelong learning, the AERQ, and ASCS about how students approach problems and put energy into challenging activities. Putting effort into challenging tasks and learning from them is a core principle of MAL, so it will be necessary to continue exploring exactly how these learners define their effort and what behaviors they identify as important.

One final point of interest was that students categorized as MALs were less likely to rely on social support to regulate academic emotions than were other students. This seems contrary in some ways to what is expected. Given existing frameworks, it stands that a performance- or avoidance-oriented student need not rely on social support for fear of losing the capital of seeming competent or for lack of social connection (Levy-Tossman, Kaplan, Assor, 2007), but this is less clear when it comes to mastery-oriented individuals. While mastery-oriented students'

may not like to perform poorly, they are likely to make the best of that experience. To return to social cognitive theory (Bandura, 1986), the opportunity for social learning is one way that students could learn and improve based on a shared analysis of performance. This is also striking in the medical education context because of the emphasis on teamwork and the importance of the clinical team in students' future practice; if students are not willing to share their experiences and learning with those around them, the functioning of the team may decline. This is an area of research that begs further questioning and may help to highlight how to best prepare MALs and other students for their futures as physicians.

Synthesis of Information

Taken together, these results extend our knowledge of medical student motivation and SRL. In some ways, this picture is clearer. There is a limited amount of research about the ASCs of medical students, so the current study provides valuable new information. This study complements the five studies discussed in Chapter Two in that it draws links between medical students' competency beliefs and other factors while doing so in the context of a U.S. medical school. Where these studies come together is that they shine a new light on the body of ASC literature. Medical students' ASCs function similarly to those of younger academic populations, but they are not the same. ASC is traditionally considered stable (Bong & Skaalvik, 2003), but in this study and others, we see patterns that would not emerge if these beliefs were as stable as expected. Much of the core literature on ASC is based in studies of students in the K-12 continuum, so the present research not only extends the medical education literature but also the ASC literature into older and professional learners. Future research in this area will be able to draw out more discrete differences in the competency beliefs of learners at all levels.

This study also serves as an advancement of MAL research. Performance has been the bottom line when it comes to the evaluation of medical students for nearly a century, and the shift towards more personalized, competency-based learning is an important step. The framework outlined by Cutrer and colleagues (2017) was a timely addition to discussions of medical education in the CBE context. Individuals go to physicians for a range of reasons, and if being a good doctor means responding appropriately to all these different requests, then students need to be prepared with the skills to interpret, adapt, and anticipate. To return to Figure 2 (p. 16), measurement of specific conceptual elements allows us to then highlight specific areas for intervention. This is an area where educational research can powerfully complement medical education. By combining knowledge about motivation and SRL with the knowledge of curriculum designers, we will be able to shape courses of study for medical students that promote competence and MAL while also extending theory into new educational settings.

The two purposes of this study were largely distinct: 1) to further our understanding of medical student learning by providing validity evidence for the ASCs of medical students, and 2) to improve our measurement capabilities in understanding the MAL. One supported the other, but the questions were not intrinsically related because self-concept was not specifically brought into the model outlined by Cutrer and colleagues (2017). By using ASC and MAL together, though, this study opens a new way to look at students. It gives us a concrete way to say, "Here is what a MAL looks like." MALs have high academic self-concepts, but given their tendency toward mastery and lifelong learning, this confidence comes from consistent effort and problem-solving. These are students who approach problems and do not back away when they encounter something challenging. While they may still hide discomfort and attempt to prove their competence, based on this sample, these qualities are not as significant as their more mastery

focused traits. At the same time, in combination with the other studies of ASC in medical students, this study helps to create a clearer picture of ASC by reaching across the varied contexts of these studies. ASC is something that is not simply a predictor of student performance but is actively created and renegotiated by students and seems to be an important element of their well-being. It is important to recognize that medical students are both students and future physicians, and each of these roles comes with its own needs.

Implications for Practice

A tool that can distinguish between MALs and other students opens the practice of medical education and educational research to new possibilities. First, there may be influences on how students are taught. If we can highlight students who interact with mastery focused tasks well, then we should be able to design and implement more opportunities for hands-on learning, self-assessment, and growth. A key element here is that to best support this kind of learning, educators will need to be equipped with the skills to provide meaningful and constructive feedback in the classroom and clinical spaces that will help learners to grow. This ability to distinguish students also opens the door for MAL skill instruction for other students.

There are also implications for student evaluation. Given that the results of this study did not suggest a relationship between MAL and grades, we must consider what we hope MAL predicts: Clinical outcomes? Patient satisfaction in practice? Continuing education? These things have meaning depending on the questions being asked, but student evaluation will differ in addressing each question or value. For example, if we hope that MAL predicts clinical outcomes, then evaluating students on academic performance would not be as meaningful as evaluating their clinical encounters. Perhaps MAL will be more useful if applied in tandem with another

framework for student outcomes. By showing that MALs perform at a different level for different kinds of outcomes, we may be able to better define a specific value for promoting it.

Implications for Future Research

This exploratory method of studying MAL and ASC is a way to begin developing context- and population-specific questions for medical students. Future research into ASC and MAL will need to focus on depth. In terms of ASC, this means additional qualitative inquiry. This study illustrated incongruity between the literature and students in this sample; providing students the opportunity to have their specific voices included in theory building will not only allow these incongruities to be explored but will also increase students' engagement with the learning environment and their field. When it comes to MAL, depth comes from diving into the other phases outlined by Cutrer and colleagues (2017). This study represents an attempt to build out measurement capabilities for mainly the planning phase, but the learning, assessing, and adjustment phases are equally important, and creating ways to capture information about students will be a necessary next step. Future research should also take advantage of longitudinal data for tool development.

Exploring how ASC and MAL change over time and how those relationships may help us understand performance in residency or into practice will provide valuable information for measurement and instruction. Given the past-oriented nature of ASC, including information about students' past academic experiences will also help to provide context and clarity to any patterns that emerge in future research studies. Using this developmental step in measuring medical students' ASCs, attention should turn towards asking other questions. For example:

- How do pre-medical school experiences shape students' ASCs?

- How does ASC change over the course of medical school and is it differentially related to other factors at different time points?
- What patterns of ASC development emerge?
- Is ASC related to clinical performance or other desired outcomes?

From this exploratory study, educational researchers are in a better position to answer these questions and others related through future research.

Limitations

It is important to address limitations in this study that may have colored the results in some way. The external validity of this study is limited due to the nature of the non-random sampling method. While the students sampled represent almost the entire entering class of a medical school, there are no outside perspectives. It is possible that students at other medical schools may have different motivational beliefs, or that the curriculum at this school attracts students with certain attributes differently.

It is also important to note that while secondary data use has certain advantages, there are corresponding limitations. This kind of data limits the ability to dive deeper because the data is bound by the original purpose for collection. In this case, the goal orientation and academic emotion regulation scales were adapted to feature reduced anchors for participant ease, but this limits the external validity and comparability of these findings. The secondary nature of the data is most concerning when it comes to statistical power. While there was no way to expand the dataset, it does pose some problems for analysis regarding statistical power. It will be necessary to continue to build evidence for these scales using larger and randomly sampled groups of medical students.

Finally, while there are outside measures of performance, students' survey responses are all self-reported and the study would benefit from an external rating of these personality factors to provide more validity evidence. Establishing this kind of evidence would also prove beneficial when it comes to expanding theoretical definitions of the constructs in question. Similarly, it will be important to conduct similar validity studies with the other scales included in this study to build evidence that they are accurate indicators of the constructs. This is particularly significant for the AERQ due to its lack of widespread use. It should be supplemented with feedback from medical students and physician faculty about what SRL strategies are most important or applicable in the context of medical education.

The need for future validity evidence also led to the decision to not recode variables loading negatively onto some of the MAL factors that emerged. These loadings reflected items that were negatively worded in the context of their associated factor. For example: the Goal Orientation item "I prefer to avoid situations at work where I might perform poorly," is scored from 1 to 4 where higher levels indicate greater agreement with an avoidance orientation. On its own this interpretation is correct. When added to the mastery factor, however, higher agreement with this item reflects a lower level of mastery, and if this item were not originally designed to stand alone, it is likely that it would have been flagged for reverse coding. The decision to not recode these items was made to most accurately reflect the true functioning of those items, but it complicated the interpretation. Without conducting a more in depth study of the functioning of this item in a reverse-coded way with other items on the scale, it seemed inappropriate to make such changes. Future research in this area should recode or alter the wording of these items to be positive to produce a MAL scale that is both accurate and interpretable. These follow-ups would be a natural component of the validation efforts and should include the voices of key

stakeholders to ensure that interpretation is not only meaningful, but also that those meanings are clearly defined by those being evaluated and those doing the evaluating.

Conclusion

Ultimately, the goal of medical education is to produce the best physicians possible, but producing the best physician requires us to know what we want that best physician to be. MAL gives us one version of this good doctor and ASC helps us to better understand MAL and students' well-being. If these are to be important goals, we will need tools to help us communicate about the populations we work with. This study successfully shed light on an understudied area of research. By building tools that can help medical educators across contexts provide support and development opportunities to students, we can actively shape medical students into the kinds of physicians we hope to see when we need medical care. Future research should continue to involve students, physicians, educators, administrators, and patients as these ideas about MAL are developed into practical ways of making good doctors. MAL as a pillar for medical student success is meaningful not only because it will help students become better physicians, but also because we should all aspire to become a MAL in our respective professions or interests. Deep, mastery-based learning, perceptions of competence, and a willingness to take chances and learn from them will benefit medical students as physicians and as people. Doesn't that sound like the kind of doctor you'd want taking care of you?

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Appendix A
Five-Factor Academic Self-Concept Scale Exploratory Factor Analysis

		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1.	Most of my classmates are smarter than I am.	**0.8331**	-0.2809	0.0345	0.0445	0.0244
2.	I am able to do better than my friends in most subjects.	**0.8141**	-0.1229	-0.1851	-0.0122	-0.0368
3.	I often forget what I have learned.	**0.6948**	-0.0497	0.3266	0.3821	0.1345
4.	I am good in most of my school subjects.	**0.6567**	0.1445	-0.1357	-0.0258	-0.1869
5.	I always do poorly on tests.	**0.4863**	0.2298	0.0209	-0.27	0.049
6.	I study hard for my tests.	-0.1711	**0.7785**	0.0403	0.1364	0.1169
7.	I will do my best to pass all subjects.	-0.0695	**0.7552**	0.1334	0.0606	-0.1451
8.	I am not willing to put more effort in my schoolwork.	-0.1005	**0.7405**	0.0424	0.1292	-0.0558
9.	I often do my homework without thinking.	-0.2399	**-0.4594**	0.117	0.3443	-0.0072
10.	I can follow the lessons easily.	0.1012	-0.0359	**-0.7869**	-0.0106	0.0531
11.	I am always waiting for the lesson to end.	0.2285	0.049	**0.6766**	0.1319	-0.1865
12.	If I work hard, I think I can match well for residency.	-0.1832	0.1774	**0.6676**	-0.0884	0.0809
13.	I do not give up easily when I am faced with a difficult question in my schoolwork.	0.1485	0.3211	**-0.481**	0.3535	-0.1207
14.	I often feel like quitting school.	0.3095	0.1756	**0.4292**	-0.1366	-0.1092
15.	I pay attention to the teachers during lessons.	0.0506	0.1833	-0.0189	**0.7592**	0.1345
16.	I am able to help my classmates in their schoolwork.	-0.0325	-0.0752	-0.1021	0.1514	**0.866**
17.	My teachers feel that I am poor in my work.	0.3548	0.287	0.0341	-0.1285	**0.4781**

Note: Bolded values indicate the highest factor loading.

Appendix B
Four-Factor Academic Self-Concept Scale Exploratory Factor Analysis

		Factor 1	Factor 2	Factor 3	Factor 4
1.	I am able to do better than my friends in most subjects.	**0.8248**	-0.1394	-0.2089	-0.0398
2.	Most of my classmates are smarter than I am.	**0.8053**	-0.282	-0.003	-0.0011
3.	I am good in most of my school subjects.	**0.6877**	0.1221	-0.1512	-0.1773
4.	I always do poorly on tests.	**0.5802**	0.1696	0.0658	0.1044
5.	I often forget what I have learned.	**0.5796**	-0.0091	0.2297	0.045
6.	I study hard for my tests.	-0.149	**0.7662**	0.0319	0.1172
7.	I will do my best to pass all subjects.	-0.0336	**0.7376**	0.1315	-0.1329
8.	I am not willing to put more effort in my schoolwork.	-0.0794	**0.731**	0.292	-0.0552
9.	I often do my homework without thinking.	-0.3762	**-0.348**	0.0468	-0.0904
10.	I pay attention to the teachers during lessons.	-0.1351	**0.2784**	-0.169	-0.0056
11.	I can follow the lessons easily.	0.1423	-0.048	**-0.7856**	0.0732
12.	If I work hard, I think I can match well for residency.	-0.181	0.167	**0.6939**	0.0876
13.	I am always waiting for the lesson to end.	0.1646	0.0718	**0.6386**	-0.2284
14.	I do not give up easily when I am faced with a difficult question in my schoolwork.	0.1054	0.3513	**-0.5537**	-0.1655
15.	I often feel like quitting school.	0.3407	0.1487	**0.4473**	-0.0898
16.	I am able to help my classmates in their schoolwork.	-0.0713	-0.0702	-0.1154	**0.8326**
17.	My teachers feel that I am poor in my work.	0.4149	0.238	0.0636	**0.5065**

Note: Bolded values indicate the highest factor loading.

Appendix C
Academic Self-Concept Scale

1. I can follow the lessons easily.
2. *I day-dream a lot in class.
3. I am able to help my classmates in their schoolwork.
4. *I often do my homework without thinking.
5. If I work hard, I think I can go to the Polytechnic or University.
6. I pay attention to the teachers during lessons.
7. *Most of my classmates are smarter than I am.
8. I study hard for my tests.
9. *My teachers feel that I am poor in my work.
10. I am usually interested in my schoolwork.
11. *I often forget what I have learned.
12. I will do my best to pass all the subjects.
13. *I often feel like quitting school.
14. I am good in most of my school subjects.
15. *I am always waiting for the lessons to end.
16. *I always do poorly in tests.
17. I do not give up easily when I am faced with a difficult question in my schoolwork.
18. I am able to do better than my friends in most subjects.
19. *I am not willing to put in more effort in my schoolwork.

Note. *Negatively worded items.

Appendix D
Jefferson Scale of Physician Lifelong Learning—Medical Students

1. Searching for the answer to a question is, in and by itself rewarding.
2. Life-long learning is a professional responsibility of all physicians.
3. I enjoy reading articles in which issues of medicine are discussed.
4. I routinely attend meetings of student study groups.
5. I read medical literature in journals, websites or textbooks at least once every week.
6. I routinely search computer databases to find out about new developments in my specialty.
7. I believe I would fall behind if I stopped learning about new developments in medicine.
8. One of the important goals of medical school is to develop students' life-long learning skills.
9. Rapid changes in medical science require constant updating of knowledge and development of new professional skills.
10. I always make time for learning on my own, even when I have a busy class schedule and other obligations.
11. I recognize my need to constantly acquire new professional knowledge.
12. I routinely attend optional sessions, such as grand rounds, guest lectures, or clinics where I can volunteer to improve my knowledge and clinical skills.
13. I take every opportunity to gain new knowledge/skills that are important to medicine.
14. My preferred approach in finding an answer to a question is to search the appropriate computer databases.

Appendix E
Academic Emotion Regulation Questionnaire

1. When I am very nervous about an exam, I decide to skip classes that day.
2. When going to school is stressful for me, I stay at home.
3. When I am afraid of an oral exam, I stay at home that day.
4. When I feel too much pressure from school obligations, I 'get sick' for a couple of days.
5. Browsing through the answers in my head helps me to reduce the pressure in exam situations.
6. Good organization of time for studying and fun reduces my tension.
7. Through investing additional effort in learning, I reduce shame due to failure at school.
8. When I feel insecure in my knowledge, I revise the material additionally.
9. If the amount of learning material scares me, I carefully organize my schedule of studying.
10. My thoughts stray to more pleasant matters when I feel frustrated by studying.
11. I start to think about something more fun when studying becomes boring to me.
12. When I get bored by the lesson, I put my mind on something interesting.
13. When I get frustrated by the teacher, I try to think about something that brings me joy.
14. When I am bored in school, I have fun with something else (I draw, chat with a friend).
15. When I am anxious in classes, I 'shut myself down' and think of something else.
16. When I am afraid of an exam/test, I tell myself that there is always a second chance.
17. When I feel bad about failing an exam, I tell myself that it is not so important to be the best.
18. I reduce exam tension by reminding myself that there are more important things in life.
19. When I am ashamed of bad grades, I remind myself that grades don't always reflect real knowledge.
20. If I'm sad because of poor grades, I comfort myself with the thought that study is not the most important thing in life.
21. I try to suppress the anger and rage I feel in class.
22. I try to hide the anger I feel towards the teacher.
23. I do not want others to see how disappointed I feel about my failures.
24. When I feel bad because of the teacher's comments, I do not want others to see that.
25. I try not to show how angry I am when the teacher is not fair.

26. I breathe deeply in order to reduce the tension that I feel in exam situations.
27. When I do a test paper, I breathe deeply to calm down.
28. When I become enraged because of a difficult task that I have to resolve, I take a couple of deep breaths.
29. When I become very angry in school, I vent my rage on others.
30. When I become furious because of studying and tasks, I start to throw things round the room.
31. I yell at someone when I become anxious in school.
32. When I fail in school, I kick or punch the first thing in my way.
33. When I become very upset in school, I start to yell at people around me.
34. When I′m nervous about some exam, I talk about it with someone who is close to me.
35. When school demands frustrate me, I share my troubles with friends.
36. When I feel miserable due to my poor grades, I pour out my troubles to someone.
37. When I feel bad due to failure at school, I talk about it with my friends.

Appendix F
Goal Orientation Scale

1. I am willing to select a challenging work assignment that I can learn a lot from.
2. I often look for opportunities to develop new skills and knowledge.
3. I enjoy challenging and difficult tasks at work where I'll learn new skills.
4. For me, development of my work ability is important enough to take risks.
5. I prefer to work in situation that require a high level of ability and talent.
6. I'm concerned with showing that I can perform better than my coworkers.
7. I try to figure out what it takes to prove my ability to others at work.
8. I enjoy it when others at work are aware of how well I am doing.
9. I prefer to work on projects where I can prove my ability to others.
10. I would avoid taking on a new task if there was a chance that I would appear rather incompetent to others.
11. Avoiding a show if low ability is more important to me than learning a new skill.
12. I'm concerned about taking on a task at work if my performance would reveal that I had low ability.
13. I prefer to avoid situations at work where I might perform poorly.

Appendix G
Final Master Adaptive Learner Scale Items

1. I enjoy challenging and difficult tasks at work.
2. I prefer to avoid situations at work where I might perform poorly.
3. I would avoid taking a new task if there was a chance that I would appear rather incompetent to others.
4. I prefer to work in situations that require a high level of ability and talent.
5. I often look for opportunities to develop new skills and knowledge.
6. Avoiding a show of low ability is more important to me than learning a new skill.
7. I can do better than my friends in most subjects.
8. I often forget what I have learned.
9. I read medical literature in journals, websites, or textbooks at least once every week.
10. I routinely search computer databases to find out about new developments in science or medicine.
11. My preferred approach in finding an answer to a question is to search the appropriate computer database.
12. I take every opportunity to gain new knowledge/skills that are important to my profession.
13. I always make time for learning on my own, even when I have a busy class schedule and other obligations.
14. Searching for the answer to a question is, in and of itself rewarding.
15. When I feel bad due to failure at school, I talk about it with my friends.
16. When I'm nervous about some exam, I talk about it with someone who is close to me.
17. When I feel miserable due to poor grades, I pour out my troubles to someone.
18. When I get bored by the lesson, I put my mind on something interesting.
19. I start to think about something more fun when studying becomes boring to me.
20. My thoughts stray to more pleasant matters when I feel frustrated by studying.
21. When I get frustrated by the teacher, I try to think about something that brings me joy.
22. When I am bored in school, I have fun with something else (I draw, chat with a friend, etc).
23. When I feel bad about failing an exam, I tell myself that it is not so important to be the best.
24. When I am ashamed of bad grades, I remind myself that grades don't always reflect real knowledge.
25. When I am afraid of an exam/test, I tell myself that there is always a second chance.

Note. Minor grammatical changes made for consistency.

Appendix H
Vita

JK Stringer IV was born on July 16, 1990, in Richmond, Virginia, and is an American citizen. He graduated from the Mathematics and Science High School at Clover Hill in Chesterfield, Virginia in 2008. He received his Bachelor of Science in Psychology from Virginia Commonwealth University in Richmond, Virginia in 2012.