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EXPLORING THE ACADEMIC WORKLOAD OF SECOND-YEAR MEDICAL
STUDENTS: A CASE STUDY

by

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M.A. University of Central Florida, 2015

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
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in the College of Community Innovation and Education
at the University of Central Florida
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ABSTRACT

Excessive academic workload has been cited as a leading cause of medical student stress, depression, and drop out. A study was conducted at a Southeastern Medical School to identify a relationship between institutionally prescribed workload (objective workload) and the students' perceptions (subjective workload). The existing school workload policy and the Rice University Center for Teaching Excellence workload estimator were utilized to calculate time to complete two types of academic artifacts: (1) assigned (required) course materials and (2) recommended (optional) course materials, which we compared at the Module level to identify difference in objective workload. The students' perceptions of workload were analyzed according to the Keller's Attention, Relevance, Confidence, Satisfaction framework for student motivation and compared to the student's statements of satisfaction for each module. Additionally, a content analysis to analyze the learning objectives for the highest and lowest instructional day workload was performed. Results from the study indicated similar objective workload calculations comparing the USCOM out of class workload policy and the RICE CTE workload estimator when the lowest difficulty and purpose parameters were selected. The selection of higher difficulty and purpose parameters within the RICE CTE workload estimator indicated a significant variance in workload calculations. Learners were generally motivated by the course content and delivery methods but preferred more self-directed learning methods. Content analysis for two courses resulted in rejection of 13% and 16% of learning objectives analyzed due to poor construction and lack of objective based language. The remainder of the learning objectives analyzed resulted in a 20% categorized as Higher Order Cognitive Skills (HOCS). Innovations of this study included categorizing medical student workload in the domains of

objective and subjective workload, the use of the Rice University Center for Teaching Excellence workload calculator as an alternative for course workload estimation, as well as well as assessing medical student's motivation utilizing Keller's model of motivation.

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I would not have been able to complete this academic journey without the assistance of all my advisors throughout this process. For fear of omission and to keep this section short; I will simply say thank you. I have learned a great deal from my mentors and will forever be in their debt for all of the challenges, opportunities, and relationships (both collegial and personal). The drive, honesty, and compassion during my mental marathon has been unequivocally supportive. My goal is to repay this kindness and professionalism by continuing to emulate your collective example for the next generation of learners.

“One of the chief defects in our plan of education in the country is that we give too much attention to developing memory and too little to developing the mind.” (Mayo, 1933)

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CHAPTER ONE: INTRODUCTION

Medical student depression, burnout, anxiety, thoughts of academic drop out, and sleep disorders may be attributed to the sheer volume of disciplinary content that needs to be learned at the institutional level, preparation for national high stakes formative assessments, and work-life balance (Dyrbye, et al., 2010; Hill, et. al, 2018; Slavin, et al., 2014). Curricular reform in medical education has long been considered the solution for advancement of student's medical knowledge from the novice to the expert clinician (Papa & Harasym, 1999). Institutional-based reform efforts are widespread and yet the problem of excessive curricular demands such as the breadth of content and the time spent learning the depth of knowledge continues to be a source of student stress (Hill, et al., 2018).

Considering this phenomenon, medical education faculty are faced with the daunting task of developing and delivering a formal curriculum that (a) embraces the need for active and independent learning, (b) provides the breadth and depth of content required to pass medical licensure examinations, and (c) simultaneously adheres to the regulatory guidance associated with student well-being. There is a pressing need to evaluate curriculum time requirements of medical school curriculum as a measure of students' workload. Further, there is a need to identify predictive instruments and tools to measure a student's perceived workload. The following study will examine institutionally prescribed curriculum workload and its impact on students' perception of workload.

Student Stress

An increase in medical students' stress levels and concern for institutionally directed academic workload has prompted increased research on medical student well-being (Dyrbye, et al., 2010; Hill, et al., 2018; Slavin, et al., 2014). The repercussions related to student stress are vast. Results from an unpublished survey completed at Stanford University Medical School indicated a perceptual disconnect between faculty and students concerning work-life balance. Most of the respondents (70%) indicated increased anxiety due to the desire to maintain academic standing using the university provided materials and informal study materials in preparation for national board examinations. Simultaneously, they were learning the *hidden curriculum*, which is important to being a *good* doctor (Prober, et al., 2016). A study of 987 medical students indicated significant anxiety concerning their high-stakes United States Medical License Examination (USMLE) Step 1 preparation as well as increased stress levels concerning academic workload with conflicts of work-life balance as the highest stressors (Hill, et al., 2018). An additional cross-sectional study of medical students ($N = 2,248$) identified 11% indicating thoughts of dropping out of medical school due to similar work-life balance concerns (Dyrbye, et al., 2010). Considering the implications of stress among medical students and the potential for increased student stress due to the demands of the curriculum, it is important to provide students with evidence on how curricular material can increase disciplinary knowledge, while respecting their work-life balance, and still enhancing the time spent on test preparation.

Medical Education Reform

At the foundation of the current medical curriculum is the historical perspective that has contributed to the current state of medical education. Multiple iterations of curriculum reform at national and institutional levels have been completed with a range of results. Current medical education follows a clinical-presentation model as the basis for mastery knowledge demonstration, which is a resounding change from the apprenticeship models of 1765. The apprenticeship model of medical education relied on rote memorization and limited clinical patient interactions. The apprenticeship model was replaced by the discipline-based model in 1871. In this model, domain-specific critical thinking and hypothetical-deductive reasoning were stressed prior to a clerkship phase. The clerkship phase emphasized cognitive and psychomotor skills mastery through patient contact. Curriculum reform of medical education considers the knowledge base structures and cognitive processes to assist students in the progression from a novice to an expert medical care provider (Papa & Harasym, 1999).

The Flexner Report of 1910 emphasized the need for medical curricula standardization (Carnegie Foundation, 2002). Since publication of The Flexner Report, approach to standardization of medical curricula has evolved through (a) anatomic organ, (b) organ system-based (1951), (c) problem-based (1971), and (d) ultimately to the current clinical-presentation and evidence-based (1991) educational structure (Papa & Harasym, 1999; Duffy, 2011). Noting the requirement for a curriculum reform framework, the Carnegie Foundation expressed the need for standardization of the medical degree attainment process (Cooke, et al., 2010). In answer to the Carnegie Foundation, the “Pillars” of Curriculum Reform (Pock, et al., 2016) were

established as a construct for domains and a systematic framework for implementation of reform efforts.

During the second year of medical school, students are required to complete the Step 1 examination prior to progressing to the clerkship portion of training, Step 1 is a 1-day examination divided into 60-minute blocks administered over an 8-hour period to assess a student's understanding and application of underlying health, disease, and modes of therapy (United States Medical Licensing Examination, n.d.). If curriculum reform is intended to better prepare the medical students to practice in the dynamic and varied field of patient care, the professional opportunities and future financial well-being is either enhanced or inhibited based in part on the students' performance on the USMLE Step 1 examination.

USMLE Step 1

Assessments are a critical part of the medical school curriculum. The USMLE Step 1 examination is a major milestone as well as a potential hurdle and pivotal life decision point for medical students. While designed to be a pass/fail evolution, USMLE Step 1 examination reports a three-digit score, which has become an indicator of aptitude for specialty Graduate Medical Education (GME) programs. Although the residency selection process does not commence until the fourth year of medical school, the USMLE Step 1 examination is a determining factor in selection for a GME residency position. The score has become the basis for aptitude in selection (National Resident Matching Program DRaRC, 2018); therefore, a higher score is interpreted as a greater aptitude and a better *match* for competitive residencies (Gauer & Jackson, 2017; Moynahan, 2018).

With the formidable implications of the USMLE Step 1 examination, medical students often exercise a degree of learner autonomy to choose how to use the institutional curriculum and which non-institutional materials to use in preparation for the exam. Unfortunately, materials utilized in individual preparation may not be aligned with institutional objectives or intentions of their training (Leff & Harper, 2006). Students begin USMLE Step 1 examination study primarily in the second year of their medical education (63.1%) with a smaller percentage starting *early study* in the first year of medical school (Burk-Rafel, et al., 2017). As the USMLE Step 1 examination approaches, students are faced with a dilemma of splitting their time and attention between university provided curriculum or third-party *informal* or parallel curriculum tools to maintain academic standing and simultaneous preparation for the USMLE Step 1 examination. Non-curricular study resources employed by medical education students include: (a) question banks, (b) flashcard programs, (c) third-party study guides, (d) websites, and (e) other materials not explicitly within the school's medical curriculum (Coda, 2019).

Survey research of medical students at the University of Michigan indicated 93% ($N = 235$) focused primarily on formal curriculum sources for the academic year, but the use of curriculum sources decreased to 17.9% as the USMLE Step 1 examination preparation began (Burk-Rafel, et al., 2017). Medical students incorporated various study strategies often prioritizing learning based on what they believe to be important to obtain a higher USMLE Step 1 examination score (Lujan & DiCarlo, 2017). Common study practices correlated with higher scores on the USMLE Step 1 examination included extended hours of reading ranging from 8 hours a day (Kumar, et al., 2015) to 11 hours a day (Burk-Rafel, et al., 2017). In addition, other test preparation activities included group study as a factor associated with higher scores (Kumar,

et al., 2015). Divided study efforts between organizational (medical school) curriculum and third-party study aids to pass and place well on the Step 1 examination may be an additional cause of student stress.

Monitoring Workload

Student stress, perceptions of workload, and time requirements of medical school have not gone unnoticed by regulatory authorities. The Liaison Committee for Medical Education (LCME) established standards for medical school educational content (LCME, 2018). One such standard requires a policy that allows students an adequate amount of time outside of the classroom for fully independent learning. LCME guidance includes a provision to limit the number of contact hours in the classroom as well as the amount of out of class homework (LCME, 2018). To facilitate the LCME standard for self-directed learning, the United States College of Medicine (USCOM), in accordance with calls for medical school reform (Cooke, et al., 2010) amended its curricular delivery from lecture-based to a blended curriculum. A blended-mode or hybrid-mode delivery in the medical education context blurs the boundaries of formal and informal learning by incorporating combinations of modalities (in class, computer based, multimedia, and online) to deliver curricular content (Reiser, 2014). The curriculum is designed to incorporate mandatory and optional in-class sessions, directed synchronous learning, as well as asynchronous content relying on the student's self-directed learning for completion. In addition, USCOM created an *Out of Class Work Policy* (United States College of Medicine, 2016) to support students required out of class learning. The policy limits institutional prescribed autonomous learning to 6 hours per week.

Assessing Student Workload

Since the 1970s, academic workload is recognized as a major contributor to student stress in the learning environment. The literature defines objective workload as the time required to complete all learning activities (Kember, 2004). Measuring and reporting objective workload is intended to provide students with an estimation of the required time for academic mastery of a course.

Objective Workload

The objective workloads have been measured and standardized in United States (U.S.) academic systems (K-12 and higher education) with the use of the Carnegie Unit (CU). However, the calculation of a CU is not the same throughout all institutions. Generally, a CU has a minimum course length of 16 weeks, 5 days a week for 1 hour of lecture plus 2 hours of homework or 3 hours of a lab (USDOE, 2008). The CU is viewed as sufficient contact hours equivalent to a unit, a certain number of units equals a credit, and a certain number of credits equals a degree (Silva, 2013).

Research associated with the measurement of objective workload has been completed in multiple academic settings and is measured in multiple ways (e.g., reading rates, survey of effort). One such measurement considers the time students spend reading and studying curricular material. Objective workload measurement has been calculated based on the reading rates of undergraduate and graduate students as an indicator of time requirements. Research on the reading rates of college students has identified rates of approximately 300 words per minute (Rayner, et al., 2016; Carver, 1982). The reading rate has been noted to decrease to 200 words

per minute for more difficult text and as little as 150 words per minute where memorization is required (Carver, 1992). When reading for comprehension, the reading rates range 100 to 400 words per minute (Carver, 1982; Rayner, et al., 2016; Siegenthaler, et al. 2011). Materials that require future engagement (i.e., cognitive knowledge requiring psychomotor association or actions) have been speculated to drop the reading rate to 50 words per minute (Parker, 1962). In this study, students' reading rates will be considered to determine objective workload.

Subjective Workload

It is important to distinguish subjective (perceived) workload from objective workload because the time the student feels they need to study can be different from the actual time investment (Kyndt, et al. 2014). Subjective workload is the combination of the academic demands and the effect of those demands on the student's perceptions of required effort (Kember, 2004). The definition of subjective workload is contentious as some postulate perceived workload cannot be directly attributed to a time measurement due to the complex constructs of academia (Kember, 2004). These complex constructs include institutionally directed teaching and assessment strategies that do not support cooperative learning as well as individual student's personal characteristics and interest in the topic (Kember, 2004). In a subjective workload, there are qualitative distinctions of useful or "good" workload and "bad" workload (Marsh, 2001). Good workload has been described as hours spent in class believed to be of value for academic achievement whereas bad workload is the total amount of time required to complete course objectives minus the aforementioned perceived useful workload (Kyndt, et al., 2014). While specific time requirements concerning perceived workload are problematic,

students' perceptions of topic difficulty, anxiety, stress, potential wasted resources, and bad workload as influencer to students' overall stress (Kyndt, et al., 2014).

The USCOM *Out of Class Work Policy* workload policy (a measure of concern in this study), and the *Students' Perception of Workload Survey* encompasses the institutional assessment of objective and subjective workload. While the methods currently used to estimate student workload were accepted by the LCME, the objective measurement is based on a single piece of research combined with USCOM faculty experience without any additional formal validation (Klatt & Klatt, 2011). There are significant gaps in prior research studies concerning both objective and subjective assessments of workload concerning U.S. medical students. Therefore, this study aims to provide evidence of second-year medical students' curricular workload by analyzing the reading rates and the *Students' Perception of Workload Survey*.

Problem Statement

A critical component of course design includes alignment of activities with the goal of decreasing students' subjective workload (Crowe, et al., 2008). Medical education has historically added evidence-based educational materials and continued a reluctance to remove an equal amount of less useful materials from curricular requirements (Gohn & Simmons, 1992; Kember, 2004). The consequences of the increase in curriculum with no associated decrease of less useful requirements is an unrealistic expectation of student objective workload. Increased objective workload has led to signs of increased subjective workload indicated by increased student burnout and depression (Slavin, et al., 2014). Additionally, students may lack the knowledge to distinguish critical parts of the curriculum to focus their efforts and select

resources that do not achieve course goals. There is a pressing need to evaluate the institutionally mandated objective workload and its correlation for estimation of subjective workload.

The following study will analyze the USCOM second year USCOM curriculum (M2) according to USCOM *Out of Class Workload Policy* as measured by the *Students' Perception of Workload Survey* (SPWS). Next, M2 will be objectively defined according to the Rice University Center for Teaching Excellence (RICE CTE) course workload estimator, which accounts for student variability of time invested in learning to determine the predictability of the tool on the results of the SPWS.

Overarching Research Questions

Research Question (RQ)1: In what ways does the objective workload differ for assigned activities between the USCOM M2 modules based on the calculation of the approved USCOM *Out of Class Work Policy*?

RQ2: Using Keller's Attention, Relevance, Confidence, Satisfaction (ARCS) framework for content analysis, to what level do the learners express their perceptions of ARCS of M2.

RQ3: How do the courses with the highest objective workload at the instructional day level differ from the course with the lowest objective workload?

Summary

Students' perceptions of workload are a factor in student stress. In this chapter, the purpose of this study has been discussed. The foundations of curriculum reform and specific

student stress associated with the potential reform process have been presented. Questions remain concerning the connection between institutionally prescribed curriculum and students' perception of workload. Chapter Two will focus on existing literature concerning aspects of the perceived problem. These domains of research include the academic requirements for obtaining a medical degree, curricular reforms associated with academic institutions, and quantifying workload calculations.

Terms

Table 1 provides a list of terms used throughout this publication. While not inclusive of every term referenced, the important ones are listed below.

Table 1

Terms and Definitions

Term	Definition
CU: Carnegie Unit	A unit of measure for academic workload equal to a course of 16 weeks requiring 1 hour a day of lecture plus 2 hours of homework or 3 hours of lab
LCME: The Liaison Committee for Medical Education	A national committee established to attest validity of medical school education
Objective Workload	Time required for the learner to complete all learning activities
Subjective Workload	The combination of academic demands and the student's perception of required effort
USCOM: United States College of Medicine	A medical school in the United States USCOM SPWS: United States College of Medicine, <i>Students' Perception of Workload Survey</i> , a survey provided to USCOM students to provide their perceptions of the medical curriculum
USMLE: United States Medical Licensing Exam	A series of examinations to assess a medical student's ability to practice medicine

CHAPTER TWO: REVIEW OF LITERATURE ONLINE

In Chapter One, the aim, purpose, problem statement, and research questions of a study examining the workload of medical students in their second year of instruction were presented. In this chapter, literature concerning the nature of curriculum reform, the theoretical foundations for the study, student motivation, stress, workload measurements, and regulatory guidance concerning the monitoring of student workload as well as the curricular path through medical school will be discussed. Finally, the research questions and related hypotheses will be posed for further investigation.

Student Motivation to Learn

As cognitive neuroscience continues to gather research on how students learn (Papa & Harasym, 1999), there has also been increased interest in the characteristics and motivations of medical students in the United States. Studies identifying U.S. medical student motivation cite intellectual curiosity, professional autonomy, altruism, and human relationships as the most common reason for choosing medicine (Pagnin, et al., 2013). Student motivation has been studied by educational psychologists and analyzed in the dimensions of cognitive, affective (or motivation), and metacognitive regulation. Studies have shown the motivational processes of medical students may be an undervalued factor in curriculum development (Kusurkar, et al., 2012).

A study of medical education conducted in China attempted to identify an interrelationship between motivations toward learning, perceptions of workload, and how the

two affected the amount of work students completed. One hundred seventy-four students were asked to keep an hourly study diary for a period of 1 week with the categories of lecture, tutorial, laboratory, assignments, revision, other study, job, and leisure/not studying. Students were provided a six-item scale for reporting their perceived workload and asked to respond to a five-point Likert scale (definitely disagree to definitely agree). Study respondents self-reported work of approximately 50 hours per week throughout the categories associated with academics (lecture, tutorial, laboratory, assignments, revision, and other study). Results were interpreted as the total amount of time students were able or willing to spend on academic activities. The study reported the proportion of total study time category shifted based on a mandate of contact time meaning when lecture or laboratory time was increased, self-study, assignments, revision, and other study time decreased (Kember, 2004).

Various factors of student academic motivation have been researched and associated with intrinsic and extrinsic motivators. Intrinsic motivators are associated with the need to accomplish or create new things while extrinsic motivators have been associated with environmental factors to include rewards (Fairchild, et al., 2005). Irrespective of motivator, completion of medical school has been linked to increased reports of relationship issues, cynicism, and a decreased satisfaction with social activities (Silva, et al., 2017). Motivation to complete medical school can be hampered by environmental barriers (e.g., financial). Students who bear increased financial concerns have demonstrated increased depression and burnout in the first year of medical school (Dahlin & Runeson, 2007).

There is limited research completed on the financial reward considerations of future employment potential and the associated stress in U.S. medical students. In contrast,

international studies have highlighted the financial stressors that students in medicine share to include a study performed by the Medical School – University of Minho (Portugal), which identified increased levels of trait-anxiety when students chose medicine for anticipated income and prestige.

Theoretical Foundation

Theory in instructional design provides a means to understand how students learn and what their motivation may be for learning. USCOM students complete an SPWS at the completion of each module of instruction. The SPWS presents a five-point Likert scale for the students to express their perceptions of course material as “Much too light and I was bored” through “Much too heavy and I was overwhelmed.” The SPWS, based on the wording of the survey, indicates not only the perception of time, but also the students’ motivation for learning. These perceptions of time and value relate to the framework provided in the Keller’s ARCS model (see Table 2). While the ARCS model has been used extensively in the healthcare setting, the foundations of ARCS have been used in studies to improve hygiene (Al-Tawfiq & Pittet, 2013) and as an assessment of motivational approaches for instructing expectant mothers (Stockdale, et al., 2014).

The ARCS model includes the four domains (Attention, Relevance, Confidence, and Satisfaction) as well as subcategories used to further enhance and describe learner motivation (Keller, 2009). The original design of ARCS was for creating learning strategies with the assertion that the four domains of human motivation can be influenced by methods of

presentation; this study will focus on the domains of Relevance, Confidence, and Satisfaction as associated with the USCOM SPWS.

Table 2

ARCS Model Components (Keller, 1987)

Attention	Relevance	Confidence	Satisfaction
<i>Perceptual Arousal</i>	<i>Goal Orientation</i>	<i>Learning Requirements</i>	<i>Intrinsic Reinforcement</i>
Provide novelty and surprise	Present objectives and useful purpose of instruction and specific methods for successful achievement	Inform students about learning and performance requirements and assessment criteria	Encourage and support intrinsic enjoyment of the learning experience
<i>Inquiry Arousal</i>	<i>Motive Matching</i>	<i>Successful Opportunities</i>	<i>Extrinsic Rewards</i>
Stimulate curiosity by posing questions or problems to solve	Match objectives to student needs and motives	Provide challenging and meaningful opportunities for successful learning	Provide positive reinforcement and motivational feedback
<i>Variability</i>	<i>Familiarity</i>	<i>Personal Responsibility</i>	<i>Equity</i>
Incorporate a range of methods and media to meet students' varying needs	Present content in ways that are understandable and that relate to the learners' experiences and values	Link learning success to students' personal effort and ability	Maintain consistent standards and consequences for success

Attention centers on the students' curiosity and interests, incorporating the subcategories of perceptual arousal, inquiry arousal, and variability. According to Keller (2009), perceptual arousal is related to curiosity and occurs when there is any "sudden or unexpected change in environment" (p. 33). Inquiry arousal enhances the learner's curiosity by providing a problem situation for the learner to solve. Variability refers to variation in instructional approach.

Relevance of course material is based on the students' perceived value of the curriculum content and includes the subcategories of goal orientation, motive matching, and familiarity (Keller, 2009). Motivation and motive matching are increased if the course content is perceived to help them achieve their specific goals. Confidence can be affected by the learner's expectation for success and is enhanced through the subcategories of learning requirements, successful opportunities, and personal responsibility (Keller, 2009).

The final concept in the ARCS framework is satisfaction, which includes the subcategories of intrinsic reinforcement, extrinsic rewards, and equity. To help maintain a desire to learn, the student must feel some satisfaction with the process and experience. Intrinsic reinforcement may include feelings of accomplishment, enhanced self-esteem, or mastery of a skill; extrinsic rewards can include grades, certifications, or advancement opportunities; and equity enhances a sense of fairness through course goals (Keller, 2009).

The ARCS model may be an appropriate lens for evaluating student motivations to learn in the USCOM based on specific domains of the ARCS. The domains and subcategories of the ARCS model associated with the SPWS are Relevance (motive matching), Confidence (learning requirements and successful opportunities), and Satisfaction (extrinsic rewards). These three categories (Relevance, Confidence, Satisfaction) and their associated subcategories can be related to the students' motivation to learn, and to the amount of time required to complete medical school academic activities. Learning requirements are expressed through the course learning objectives and are associated with objective workload. Objective workload is then interpreted by the student to establish subjective workload, which is based on the students feeling and stress associated with course requirements.

Student Mental Health

Medical school can affect students' mental health. Medical students experience depression, burnout, suicidal ideation, and thoughts of dropping out of school throughout their formal education programs. Causes of these stressors include: (a) poor time management, (b) conflict of work-life balance, (c) peer relations, (d) study time management, (e) financial stressors, (f) the volume of information, (g) future occupational uncertainty, and (h) the desire to succeed (Hill, et al., 2018). Other research has suggested that medical students are at a higher-than-average risk of becoming dependent on alcohol, due in part to stress such as mounting educational debt (Jackson, et al., 2016).

Medical students have identified their levels of stress and its effects on their ability to perform in medical school. In one study ($N=1,137$), 11.2% of medical students considered their stress severe and debilitating, 68.6% considered their stress significant but manageable, 15.4% mild, and 3% expressed no stress (Hill, et al., 2018). An additional study and meta-analysis including 17,431 medical students, indicated that 8,060 suffered from burnout (44.2%) before residency. Responses to the survey described depressive triggers and symptoms as emotional exhaustion (40.8%), depersonalization of the academic environment (35.1%), and a feeling of diminished personal accomplishment (27.4%) (Frajerman, et al., 2019).

A prospective cohort and cross-sectional cohort of medical students ($N = 2,248$) identified 11% noted serious thoughts of dropping out of medical school. Further, these serious thoughts of dropping out showed a strong relationship with measures of personal distress (depressive symptoms), professional distress (burnout), or experiencing significant negative life events (Dyrbye, et al., 2010). These feelings did not improve even into post medical school as

depression still lingered. A national survey compared the burnout rates of medical students, residents, and early career physicians relative to the U.S. population. Of the healthcare workers surveyed, 4,402 (35.2%) indicated medical students have increased odds of depressive symptoms and suicidal ideations as compared to a similar population control sample ($p < .001$) (Dyrbye, et al., 2014).

Medical students' burnout and depression have been tied to curricular material and requirements. In one study, a small percentage of students ($N = 73$) perceived the institutional curriculum to be poorly designed and organized with limited applicability to the USMLE exams. The lack of curricular utility increased the student stress and pushed them to seek alternate methods for USMLE examination study. Additionally, 93 students expressed anxiety related to institutional training, career planning, residency, and governmental changes concerning reimbursement of medical providers. One hundred forty-seven noted financial concerns ranging from indebtedness and future earning potential as included stressors (Hill, et al., 2018).

Few medical students seek help for depressive symptoms due to embarrassment, confidentiality concerns, and fear of stigmatization (Chew-Graham, et al., 2003; Givens & Tjia, 2002; Wimsatt, et al., 2010). The prevalence to not seek assistance for depressive symptoms requires institutional policy to monitor the student's well-being. After the suicide death of a physician at the University of California, a Suicide Prevention and Depression Awareness program was implemented for all staff, including students. One hundred thirty-two of 498 students participated in the study (27%) of which 32% required conversations with a counselor, 8% required in-person evaluations, and 11% were referred to mental health for treatment. Mental health referrals represented 3% of the student population at one school suffering from mental

illness requiring psychiatric support (Moutier, et al., 2012). Albert Einstein School of medicine created WellMed, a comprehensive wellness program to incorporate multiple dimensions of wellness into a single program. The program includes physical health, mental health, spiritual wellness, social wellness, physical fitness, nutrition, intellectual wellness, and financial wellness. No results were reported as to the efficacy of the WellMed course (Ludwig, et al., 2015). Factors associated with increased depression may be affected by curriculum reform efforts.

Medical Education and Financial Implications

The academic path to a medical degree includes: (a) obtaining a baccalaureate degree, (b) earning a competitive assessment score on the Medical College Admissions Test (MCAT) application, (c) being accepted, and successfully completing medical school courses, (d) completing graduate medical education (residency), (e) passing board certification, and (f) obtaining state licensure. Interspersed throughout the linear academic progression are three high stakes examinations (USMLE Steps 1, 2, and 3). These examinations are designed to assess cognitive and psychomotor mastery of concepts required of a practicing physician.

The path to medical school starts with completion of an undergraduate education from an accredited college or university. Typically, during the junior year of an undergraduate degree, students wishing to pursue a career as a medical doctor must register and complete the MCAT as well as apply to medical schools. The MCAT is a standardized, multiple-choice examination whose results have been shown to be predictive of success in medical school (Dunleavy, et al., 2013). If accepted to medical school, students begin the prescribed medical school's education curriculum. At most medical schools, the curriculum is inclusive of 2 years of didactic

(classroom) foundational medical science courses followed by 2 years of supervised patient contact through clinical rotations. In most U.S. medical schools, students take the USMLE Step 1 examination upon completion of the didactic portion of school (at the end of Year 2). The Step 1 examination is a major milestone as well as a potential hurdle and pivotal life decision point for medical students.

The second 2-year block of medical education, referred to as the clerkship phase, is designed to develop the student's application of the basic sciences in various areas of medicine. The Step 2 examination of the USMLE is administered during the fourth year of medical school and consists of two components: Clinical Knowledge and Clinical Skills. The Step 2 Clinical Knowledge examination is a multiple-choice examination designed to assess the medical knowledge (cognitive) to care for patients while under the supervision of a licensed physician. The Step 2 Clinical Skills examination is designed to assess the student's ability to: (a) gather information from a patient pertaining to their state of health or chief complaint, (b) perform clinical examinations, (c) synthesize clinical information for a diagnosis, (d) formulate a treatment plan, (e) communicate diagnostic plan with a patient, and (f) document the patient encounter (psychomotor and affective) (USMLE, n.d.).

The final test prior to unsupervised care of patients is the Step 3 examination. This test delivered in two parts consists of a multiple-choice examination designed to assess the student's ability to apply medical knowledge and a practical demonstration of biomedical and clinical sciences knowledge and skills through a simulated patient encounter. This is a 2-day test that emphasizes the Foundations of Independent Practice and Advanced Clinical Medicine (ACM),

which are essential for unsupervised patient care, specifically in the ambulatory care setting (USMLE, n.d.).

Predicting student performance, specifically on the Step 1 examination, has been a continued source of research. Models have been used that combine pre-matriculation scores (MCAT) and combinations of first- and second-year institutional level performance with some positive results. Previous literature has indicated a positive correlation between pre-matriculation scores and first year performance on allopathic medicine curriculum with Step 1 examination scores (Gonella, et al., 2004). This was echoed by additional research in an osteopathic medicine curriculum across 3 years of a cohort with a peak correlation coefficient of 0.75 (Gullo, et al., 2015). Finally, a study performed using pre-matriculation and the second-year academic performance at USCOM identified the institutionally developed curriculum and assessments were predictive of USMLE Step 1 performance (51%, $R^2 = 0.51$) (Lee, et al., 2017).

After medical school graduation, students are required to complete at least 1 year of Graduate Medical Education (GME) or residency. Although the residency selection process culminates in the fourth year of medical school, the Step 1 examination (taken upon completion of the second year of undergraduate medical education) is a determining factor in selection for a GME residency position. While designed to be a pass/fail evolution, the Step 1 examination reports a 3-digit score, which has become the basis for aptitude in selection to GME residency programs (National Resident Matching Program DRaRC, 2018). A higher score is interpreted as a greater aptitude and a better *match* for acceptance into competitive residencies programs (Gauer & Jackson, 2017; Moynahan, 2018). The minimum passing score for the Step 1 examination is 194 (United States Medical Licensing Examination, n.d.), unfortunately, this

score does not identify the aptitude required for the highly competitive, lucrative, or GME specialty fields considered to provide a controllable lifestyle (Patel, et al., 2010).

Irrespective of the Step 1 examination scores, there is a possibility for a student to not match with any residency program. A student may fail to match with a program due to academic achievement, professional or interpersonal skills, or the availability of residency programs. Students with lower academic performance may not be selected for GME residency based on a non-competitive USMLE Step 1 examination score or failure of the exam. Professional electives or interpersonal skills may also limit residency matches due to a lack of background in the field or poor interview skills (American Medical Association, 2015). An additional reason for lack of a GME match position is the limited number of positions available. In 2016, the number of students seeking a residency program was larger than the residency program availability (27,293 residency availability for 27,655 students). If a student fails to match for a residency on their first attempt, the process of a second round of residency matching becomes increasingly competitive as medical school graduates compete for positions with other non-matched students (Brumsted, et al., 2017).

USMLE Step 1 and Financial Implications of Performance

Framing a discussion concerning motivation and stress associated with medical students requires insight towards the financial implications of not only medical school costs, but also future earning potential. The Step 1 examination is a major milestone, potential hurdle, and career decision point for medical students due to the GME matching (National Resident Matching Program DRaRC, 2018). A passing score on the Step 1 examination may not be

sufficient to secure the future lifestyle or earning potential residency programs the students' desire. GME specialties that require a higher skill level ultimately receive the highest-paying salaries. Various factors for this financial motivation and its effect on academic stress have been researched around the world to include intrinsic and extrinsic motivators (Park, et al., 2012), burnout and career choice motivation (Pagnin, et al., 2013), and comparisons to other medical professions (Crossley & Mubarik, 2002).

An online survey conducted of 20,000 physicians across 29 specialties indicate the procedure-based specialties draw the largest salaries including plastic surgery (\$500,000), orthopedics (\$497,000), radiology (\$401,000), and dermatology (\$392,000). In contrast, the lowest-paying GME specialties included primary care fields such as internal medicine (\$230,000), family medicine (\$219,000), and pediatrics (\$212,000) (Murphy, 2018). Mean scores for a student to be considered for GME residency match in plastic surgery is 238, orthopedics is 249, interventional radiology is 248 while diagnostic radiology is 242, dermatology is 242, internal medicine is 235, family medicine is 219, and pediatrics is 222 (National Resident Matching Program, 2018). Controllable Lifestyle specialties are those which offer regular and predictable work hours, leaving more personal time for leisure or family pursuits. Controllable Lifestyle specialties are considered anesthesiology, dermatology, emergency medicine, neurology, otolaryngology, pathology, psychiatry, and radiology (Patel, et al., 2010).

The desire to perform well may be linked to students' allocating additional time to learn content. Therefore, it is important to evaluate the time students perceive they are studying

materials prescribed by the medical school and the time students are allocating to study additional curricular support materials.

Curriculum Reform

Medical education reform has been called varying names but is an overarching term meaning adjustments made to medical curricula. In this study, curriculum reform will be presented in the classification method expressed in the “Pillars” of Curriculum Reform (see Figure 1) (Pock, et al., 2016). The Pillars report expressed four key components, labeled I through IV. Pillar I addresses standardization of learning outcomes and individualization of the learning process. This Pillar advocates for competency-based progression versus a pre-established timeline, multiple-choice question use, increased use of concept mapping, and clerkship entry within the first 18 months of medical school matriculation. Pillar II advocates for an earlier clinical environment entry and an integration of formal knowledge and clinical expertise by approaching the body on an organ-system module. Additionally, this Pillar addresses the use of spaced education (Kerfoot, et al., 2007) to increase clinical knowledge retention in students. Pillar III proposes to establish a foundation of scientific inquiry by developing students’ scientific exploration of futuristic therapies based on recent advances in medicine. Finally, Pillar IV addresses the art as well as the science of medicine by encouraging communities of practice, team-based learning, and discussing humanism, medical ethics, and societal obligations of the medical profession.



Figure 1: Pillars of Curricular Reform Retrieved from: Pock, Pangaro, & Gilliland, The "Pillars" of curriculum reform, 2016

Initiating Events for Curriculum Reform Initiation

Curricular reform has been initiated at institutions for numerous reasons. At some universities the reform effort initiation centered on Pillar I in anticipation of (Dienstag, 2011), or immediately after, an LCME visit (Irby, et al., 2004), a desire to implement change identified as successful at other medical schools (Pock, et al., 2013), or to continue reform based on in-house

success of other programs (Fischel, et al., 2018; Wackett, et al., 2016). In other institutions, a review of the curriculum identified misaligned course objectives and goals (Post, et al., 2008; Dyrbye, et al., 2011), a desire to introduce new learning methods or methodologies (Cha, et al., 2006; Stewart, et al., 2011; Einstein, et al., 2014), or methods of optimizing or individualizing pedagogical methods of instruction (Dienstag, 2011; Wackett, et al., 2016; Fischel, et al., 2018). Finally, other schools identified (Chamberlain, et al., 2008) or presumed deficiencies in specific aspects of their programs (Slavin, et al., 2009; Rosenblatt, et al., 2006; Cosgrove, et al., 2014).

Initiating factors for reform efforts focusing on Pillar II were a desire to combine residency programs (Wilkins, et al., 2017) or improve career advising for medical students in their senior year (Perlman & Stagnaro-Green, 2009). An additional reason for the reform efforts focused on a perceived societal need for new materials (Williams, et al., 2014). Overwhelmingly, the Pillar II reforms have been centered on a lack of specialty training courses at the clerkship level (Quill, et al., 2003; Medina-Walpole, et al., 2004; Cha, Ross, et al., 2006; Deterding, et al., 2007; Kitzes, et al., 2007; Sierpina, et al., 2007; Borkan, et al., 2009; Perlman & Stagnaro-Green, 2009; Stewart, et al., 2011; Hoppmann, et al., 2015).

Pillars III and IV are the least represented in the literature concerning curriculum reform initiation. Pillar III identifies a desire to integrate early professional identity and competencies for millennial students (Wackett, et al., 2016; Fischel, et al., 2018) and increase research opportunities in the third year of the curriculum (Gronchowski, et al., 2007). Other institutions implemented a required scholarly activity or research project (Cha, et al., 2006; Rosenblatt, et al., 2006; Deterding, et al., 2007; Cosgrove, et al., 2014). Finally, reform initiation events associated with Pillar IV include integration of humanistic skills, moral reasoning, or self-reflection

(Brunger & Duke, 2012) and an emphasis on the hidden curriculum of medical school (Litzelman & Cottingham, 2007).

Curriculum Reform Interventions

Pillar I has been addressed by adjusting instructional strategies to include self-directed or case-based learning (Deterding, et al., 2007), competency-based learning (Litzelman & Cottingham, 2007), and problem-based learning (Deterding, et al., 2007; Dienstag, 2011) or to standardize the assessment strategies for active learning (Chamberlain, et al., 2008; Deterding, et al., 2007; Fischel, et al., 2018; Wackett, et al., 2016). Other schools have addressed faculty development and recruiting (Litzelman & Cottingham, 2007; Perlman & Stagnaro-Green, 2009; Stewart, et al., 2011) and a systematic restructuring of the curriculum to assure vertical and horizontal thematic integration (Dyrbye, et al., 2011; Hoppmann, et al., 2015; Kitzes, et al., 2007; Medina-Walpole, et al., 2004; Quill, et al., 2003; Williams, et al., 2014). Additionally, standardization of small group instruction was prevalent in the literature (Dienstag, 2011; Pock, et al., 2013; Medina-Walpole, et al., 2004; Quill, et al., 2003; Williams, et al., 2014).

Pillar II has been addressed by decreasing aspects of the curriculum (Chamberlain, et al., 2008; Cosgrove, et al., 2014; Dienstag, 2011; Dyrbye, et al., 2011; Fischel, et al., 2018; Gronchowski, et al., 2007; Rosenblatt, et al., 2006; Wackett, et al., 2016) or increasing other aspects of clinical education. These aspects include increased opportunities for critical thinking and realistic problem solving (Chamberlain, et al., 2008; Dyrbye, et al., 2011; Post, et al., 2008) and the introduction of various clinical environments (Deterding, et al., 2007; Fischel, et al., 2018; Silverman, et al., 2012; Wackett, et al., 2016; Williams, et al., 2014). In other cases,

sequencing of instruction or assessments was completed (Abbott, et al., 2010; Dyrbye, et al., 2011; Morrow, et al., 2011; Ogrinc, et al., 2011; Pock, et al., 2013; Post, et al., 2008; Quill, et al., 2003).

Pillars III and IV are the least represented in the curriculum reform process. Some schools have increased the requirement for scholarly activities in research (Cha, et al., 2006; Cosgrove, et al., 2014; Deterding, et al., 2007; Dienstag, 2011; Pock, et al., 2013; Rosenblatt, et al., 2006) or dedicated an entire year of the curriculum to research (Gronchowski, et al., 2007). In other schools, new courses have been created (Silverman, et al., 2012), grouped or restructured (Coates, et al., 2008), or enhanced with new content (Fischel, et al., 2018; Wackett, et al., 2016) to assist the learner in establishing a foundation for scientific inquiry. Discussion of humanistic skills and moral reasoning (Brunger & Duke, 2012) as well as an emphasis on the hidden curriculum (Litzelman & Cottingham, 2007) have been of primary curriculum reform concern to school associated as they associate to Pillar IV.

Curriculum Reform Results

Results of curriculum reform indicate a sustainment or an increase in student Step 1 and Step 2 performance scores (Christianson, et al., 2007; Kitzes, et al., 2007; Litzelman & Cottingham, 2007; Abbott, et al., 2010; Wackett, et al., 2016; Fischel, et al., 2018). The overwhelming results concern informal and formal student feedback on end-of-year surveys (Cha, et al., 2006; Christianson, et al., 2007; Kitzes, et al., 2007; Chamberlain, et al., 2008; Coates, et al., 2008; Post, et al., 2008; Day, et al., 2009; Abbott, et al., 2010; Dyrbye, et al., 2010;

Stewart, et al., 2011), except for a single article that shows a correlation between reform efforts and student residency selection (Slavin, et al., 2009).

Though curriculum reform has been significant in recent literature, underlying reasons for initiation of reform efforts and associated interventions do not specifically address the issues of student workload. Additionally, many of the results reported do not associate student well-being and the curriculum reform process.

Liaison Committee for Medical Education Guidance

The U.S. Department of Education recognizes the LCME as the accrediting body for institutional programs. Accreditation is a voluntary process granted through regional agencies after assessment of the institution's compliance with LCME guidance (Liaison Committee on Medical Education, n.d.). To achieve or maintain accreditation, the institution must provide documentation of faculty, student, and graduate performance within the standards of the LCME guidance, Standard 8: Curriculum Management, Evaluation, and Enhancement, substandard 8.8, describes the general requirements for accreditation pertaining to student workload. The institution must attest the curriculum specifies the amount of time medical students spend in required activities to include during clerkship (LCME, 2018).

Workload Measurement

Academic workload can be described as objective and subjective. Objective workload is defined as the time required to complete all learning activities within a course of instruction

(Kember, 2004). Measuring and reporting objective workload is intended to provide students with an estimation of the required time for academic mastery of a course. One metric utilized in U.S. academic systems (K-12 and higher education, inclusive of medical education) is the CU (Silva E., 2013), while the European Higher Education uses the European Credit Transfer and Accumulation System (Karjalainen, et al., 2006). Subjective workload is the combination of the demands placed on the student and the effect of these demands on the student's perception of academic and social requirements (Kember, 2004).

It is important to distinguish objective and subjective workload because the time the student feels they need to study can be different from the actual time investment. The perception of good workload is all assignments required to complete the course objectives. This definition has been used for nearly 20 years in the Course Experience Questionnaire for obtaining student feedback (Kyndt, Berghmans, Dochy, & Bulckens, 2014). In contrast, the student's perceptions of topic difficulty, anxiety, stress, potential wasted resources, and bad workload as influencer to students' overall stress (Kyndt, et al., 2014). Research has been completed to identify a link between good and bad workload through various methods to include assessing perceptions of student workload as well as reading rates as a measure of workload.

Reading Rates as a Measure of Workload

The reading rates of college students has been identified to vary from 400 words per minute to 50 words per minute depending on the context and intended use of the materials (Rayner, et al., Siegenthaler, et al., 2011 2016; Carver, 1982; Parker, 1962). Literature associating reading rates as an indicator of objective or subjective workload of medical students

is limited. A study performed at a California university of second-year medical students provides insight to the sheer volume of reading and self-reported reading rates of medical students. Participants ($N = 108$) report their reading rates (number of pages per hour) upon initial reading of the text. Additionally, the participants were asked to estimate the total number of hours reading throughout the year.

The study initially calculated the total number of textbook pages associated with required and recommended reading as prescribed by the course outline (objective workload). Total required reading included 10,997 pages with recommended reading totaling 7,124 pages. Using the self-reported reading rate mean of 20 pages per hour (range of 2 to 40 pages per hour), calculations imply a reading load of 1,712 hours annually and 42 hours per week to complete required reading materials. Similar calculation for recommended reading adds an additional 9 hours per week (Gohn & Simmons, 1992). The study scope did not include any association with the students' perception of workload as an indicator of stress.

During the second year of medical school, students enter the clerkship phase and may be encouraged by faculty and peers to read about their patient conditions as well as materials related to clinical rotations. A study administered an 18-item survey tool to 120 students during an internal medicine clerkship focusing on the content and frequency of additional reading concerning patient conditions they encountered. Results indicated medical clerks read approximately 10.8 hours a week with a participant reading range of 1 to 30 hours. Required reading included online journals, test preparation books, and medical textbooks. Difficulties were expressed by the respondents concerning time-management, appropriate source materials, and conflicting guidance from advisor staff as they pertain to reading efforts (Leff & Harper, 2006).

While the difficulties expressed by the participants of the study were not specifically identified, the responses fall within the previous definitions of subjective workload.

Klatt and Klatt (2011) investigated the total amount of reading required during a 71-week, 12-module, preclinical science curriculum. Total faculty assigned reading included 29,239 pages equaling 496 pages per week. The study assumed a framework similar to Carver (1992) and included assessment of reading materials in five levels with associated reading purpose and rates. Students reported hourly page reading rates ranging from less than six pages (less than 50 words per minute) to greater than 25 pages (greater than 200 words per minute). Calculation based on the respondents self-reported reading rates indicate completion of institutionally prescribed objective workload required 496 pages and 28 to 41 hours per week.

RICE CTE Course Workload Estimator

The use and validation of course workload estimation calculations may be a critical tool for curriculum planners to deliver a realistic workload for students. One such tool suggested for use in medical education is the RICE CTE Course Workload Estimator. Developed by Rice University, this tool estimates time invested by evaluating the density of the reading content. Limited empirical studies have been conducted utilizing the tool. A presentation at the Southern Group of Educational Affairs adapted the tool for course assessment, finding the calculations of required course content was within the specified schools workload policy. In contrast, the addition of recommended reading far exceeded the school policy (Pollock, et al., 2019).

Through reviews of research on reading and writing rates, Rice University developed this web-based, open source, course workload estimator, which is used by multiple private

companies and universities as the standard for calculations of workload associated with student assignments (Rice University, 2019). These workload calculations are variable based on the aspects of complexity of the text and the conceptual scaffolding required (new concept, some new concepts, or many new concepts). Moreover, the tool considers the cognitive level required for mastery of the information (survey, understand, or engage). To date, there are no published academic studies analyzing medical education students' workload using the RICE CTE. Within the RICE CTE, the reading column will be used for all calculations which include: (a) number of pages required for the learner to read, (b) density of the words on the page, (c) difficulty of the information, and (d) intended purpose of the material (see Figure 2).

Course Workload Estimator

Note: An enhanced version with new features has been released!
[Click here to switch to the Enhanced Course Workload Estimator](#)

<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">READING</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Pages Per Week: <input style="width: 100%;" type="text" value="0"/> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Page Density: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> 450 Words ▼ </div> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Difficulty: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> No New Concepts ▼ </div> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Purpose: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> Survey ▼ </div> </div> <div style="margin-top: 10px;"> Estimated Reading Rate: 67 pages per hour </div> <div style="margin-top: 5px;"> <input type="checkbox"/> manually adjust </div>	<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">WRITING</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Pages Per Semester: <input style="width: 100%;" type="text" value="0"/> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Page Density: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> 250 Words ▼ </div> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Genre: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> Reflection; Narrative ▼ </div> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Drafting: <div style="border: 1px solid #ccc; padding: 2px; display: flex; justify-content: space-between;"> No Drafting ▼ </div> </div> <div style="margin-top: 10px;"> Estimated Writing Rate: 0.75 hours per page </div> <div style="margin-top: 5px;"> <input type="checkbox"/> manually adjust </div>	<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">EXAMS</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Exams Per Semester: <input style="width: 100%;" type="text" value="0"/> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Study Hours Per Exam: <div style="display: flex; align-items: center;"> <input style="width: 100%; height: 15px; margin-right: 5px;" type="range" value="0"/> 0 5 10 15 20 25 30 35 40 45 50 </div> </div> <div style="text-align: center; font-weight: bold; margin-bottom: 10px;">OTHER ASSIGNMENTS</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> # Per Semester: <input style="width: 100%;" type="text" value="0"/> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Hours Per Assignment: <div style="display: flex; align-items: center;"> <input style="width: 100%; height: 15px; margin-right: 5px;" type="range" value="0"/> 0 5 10 15 20 25 30 35 40 45 50 </div> </div>	<div style="text-align: center; font-weight: bold; margin-bottom: 10px;">COURSE INFO</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> Class Weeks: <input style="width: 100%;" type="text" value="15"/> </div> <div style="text-align: center; font-weight: bold; margin-bottom: 10px;">ESTIMATED WORKLOAD</div> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px; text-align: center;"> 0 out of class hrs/wk </div> <div style="text-align: center; color: #0070c0; margin-bottom: 10px;"> Estimation Details </div> <div style="text-align: center;"> Research & Design Elizabeth Barre Justin Esarey </div>
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Figure 2: RICE CTE Course Workload Estimator

Content Analysis Literature

Content analysis has been previously utilized in medical education research to examine curricular components, teaching methods, and clinical clerkship along with other areas of medical education (Dimitroff & Davis, 1996). In this study, content analysis was a chosen methodology for analyzing the learner's feedback associated with the SPWS.

There is diversity in approaches to qualitative content ranging from impressionistic interpretation to a systematic analysis of text (Finfgeld-Connett, 2014). Content analysis has been used in identifying messaging found on offshore medical schools' websites (Morgan, et al., 2017), medical student participation and utility of Facebook groups (and the utility of mobile learning applications for clerkship clinical practice) (Nicolai, et al., 2017). Additional research identifies its use to analyze medical students' comfort with treating Lesbian, Gay, Bisexual, Transgender, and Questioning patients. Students were presented with online questionnaires followed by group recorded interviews featuring open-ended questions. The questions were coded, assessed for interrater reliability, and reported (Hayes, et al., 2015).

Specific to curricular concerns, content analysis has been used in various medical school settings. One study performed content analysis to identify learning gaps in the purpose statements and learning objectives of an online Human Papilloma Virus vaccine continuing medical education course. Content analysis identified a gap wherein an affective outcome was associated with a cognitive knowledge learning objective. This identification prompted a recommendation for clear and intentional purpose statements and learning objectives as an imperative for course development (de Leeuw, et al. 2019). In an additional study, content analysis was used to identify the frequency of keywords pertaining to pain management as well

as the context in which it was used. The context analysis was used to assist in the association of pain as a symptom of a medical process or the disease itself. Conclusions of the content analysis identified fragmentation of learning content due to differing viewpoints from the faculty creating the content (pain as a symptom versus pain as a disease process unto itself). This study provided a starting point for curriculum-based reform of the pain management medical education (Bradshaw, et al., 2017). Content analysis methodology has been employed by the American Association of Colleges of Osteopathic Medicine to assess the learning objective verbs and contexts used in categorizing various cognitive and knowledge domains. Bloom's Taxonomy was used as a framework for analysis in identifying the majority of competencies in osteopathic medicine that focus on the apply and procedural cognitive and knowledge dimensions (Rosenberger, et al., 2017).

Blooming Biology Tool

The Blooming Biology Tool (BBT) is based on Bloom's taxonomy and was designed to assist science faculty in alignment of learning objectives and assessments in discipline specific postsecondary education (Crowe, et al., 2008). Bloom's Taxonomy of cognitive domains (Bloom, et al., 1956) is a well-defined tool accepted as a standard for categorizing levels of cognition into six levels: (a) knowledge, (b) comprehension, (c) application, (d) analysis, (f) synthesis, and (g) evaluation. Further refinement of the taxonomy (Anderson, et al., 2001) converted category titles to the active verbs of remember, understand, apply, analyze, create, and evaluate. Bloom's taxonomy has been used extensively in K-12 education but been applied in a limited fashion in higher education. It has also been used to design rubrics for evaluating student

performance in biology exams, develop formative assessment questions at an appropriate cognitive level, and in the development of courses (Crowe, et al., 2008).

Academic foundations of medical education require a knowledge of human biology and chemistry as well as a combination of Lower-Order Cognitive Skills (LOCS) and Higher-Order Cognitive Skills (HOCS). LOCS require minimal levels of understanding while HOCS require a deeper conceptual understanding, which has shown to be problematic in some research (Zoller, 1993; Bailin, 2002). Using the original iteration of Bloom's taxonomy (1956), the BBT defines the levels as either a LOC, HOC, or a combination of LOC and HOC. Knowledge and comprehension are considered LOCs, application is a transition between LOC and HOC, and analysis, synthesis, and evaluation are HOCs. The assumption is medical faculty design learning objectives and course content to enable medical student's higher-order cognitive skills. When evaluated for biology content, a high percentage of faculty identified only 25% of their exam questions were within the HOC classification (Crowe, et al., 2008). There has been no research on the BBT in medical education in its use as a predictive tool for student perceived workload.

Research Questions

RQ1: In what ways does the objective workload differ for assigned activities between the USCOM M2 courses based on the calculation of the approved USCOM *Out of Class Work Policy* and the RICE CTE Workload Estimator?

RQ2: In what ways, if any, did students express their motivation of learning for the USCOM M2 according to Keller's ARCS Model of Motivation?

RQ3: How do the courses with the highest objective workload at the instructional day level differ from the course with the lowest objective workload?

Summary

In recent history, there has been an increase in medical student burnout and depression attributed to the workload associated with medical schools. Curriculum reform has taken place at multiple universities with varying degrees of efficacy; yet none has reported student workload as an inciting event to curricular reform. LCME guidance to address workload has been published as a requirement for medical school accreditation, but there is limited to no directive guidance or standard of assessing objective workload. Student workload is divided into *objective* and *subjective* categories. Objective workload is defined as the institutionally prescribed tasks to complete curricular events (learning objectives, reading assignments, etc.) and subjective workload is defined as the student's perception of the prescribed workload. Assessing time requirements for objective workload has been associated with reading rates of college students, but there is limited research on medical students' reading rates. There is a pressing need to identify predictive instruments to limit the burden placed on medical student's mental health due to institutionally prescribed objective workload.

CHAPTER THREE: METHODOLOGY

Introduction

The purpose of this study is to measure the predictability of the USCOM *Out of Class Work Policy* and the RICE CTE course workload estimator, this study is important because the medical school curriculum is historically overloaded in content and the impact of the volume of information to learn can contribute to medical students becoming increasingly stressed about their workload, time management to learn information, and conflicts in work-life balance (Hill, et al., 2018). Previous research has indicated second-year medical students display significantly higher levels of exhaustion and cynicism when compared to other medical students; therefore, investigating tools to predict the workload of this population would provide needed information for curricular reform (Estupinan & Kibble, 2018).

Sample Population

The study will retrospectively analyze an existing database within the USCOM of second-year medical student.

Nationally, the gender identification of similar populations for this year is 51.4% male and 48.6% female. In 2015, the ethnic and racial composition of medical school students included 51% white, 20% Asian, 7% Black or African American, 7% Hispanic, Latino, or of Spanish origin. The remaining percentage is distributed between non-citizen/permanent resident, multiple race ethnicity declaration, native Hawaiian or Pacific Islander, and other declarations of

ethnicity (Association of American Medical Colleges, 2020). While these factors are not a determinant in this study, the USCOM population is representative of the national averages.

Coders

There were three coders that coded learner comments for the content analysis conducted. Each of these coders were women, of which two held graduate degrees—one a Doctor of Philosophy in Instructional Design and the other a Master of Arts in Education. The final coder was an undergraduate student in her final year of bachelor’s studies. These coders worked independently when coding. The two coders with graduate degrees had prior experiences as instructional designers. The undergraduate coder intends to attend medical school. The coders represented a range of ages and experiences. Their valued perspectives were informed by their experiences in education as students and educators as well as their prior work experiences.

Data Source

Curriculum Structure

To answer the research questions (RQ1–RQ3), all artifacts available via the Learning Management System (LMS) for M2 will be collected and time coded using the USCOM *Out of Class Work Policy* and the RICE CTE Workload Estimator. M2 includes components designed to engage the learner’s cognitive, psychomotor, and affective domains. Cognitive components of the curriculum include modules introducing human body systems: (a) Endocrine, Reproductive, and Genitourinary, (b) Cardiovascular and Pulmonary, (c) Gastrointestinal and Renal, (d) Skin

and Musculoskeletal, and (e) Neurologic. Information is presented by assigned or recommended activities such as readings, case presentations, Microsoft (MS) PowerPoint (PPT)-based self-learning modules, and narrated videos. Psychomotor and affective growth is addressed with a continuous Practice of Medicine course (P-2). P-2 is a concept application component continued from the first year of medical school. In the P-2 module, learners associate cognitive skills to psychomotor and affective skills required for completion of medical school and future patient care. To answer RQ4, the SPWS data will be deidentified and provided for analysis of Question 10 and Question 12.

Course length for the M2 portion of the curriculum (see Table 3) is continuous throughout the academic year. For the purposes of the workload calculation, only artifacts used in the cognitive domain will be assessed to determine potential workload, while these calculations represent 50% of the actual workload, quantitative analysis of institutionally prescribed artifacts will provide more consistent reliability. M2 data will be recorded on a spreadsheet and divided into Course Reference Information (CRI) and Session Artifact Information (SAI) (see Table 4 and Table 5).

Table 3

Data Spreadsheet for Module Level Workload Calculations

	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
M2	M2-Orientation Assist with M-1 Orientation Diagnostic Tools (1 week)	P-2 Practice of Medicine II (31 weeks) Community of Practice (includes nutritional service, WIC, Elder care, etc.)							
		I-2 Focused Individualized Research Experience II (31 weeks)							
		S-2 Endocrine, Reproductive, and Genitourinary System (6 weeks)	S-3 Cardiovascular and Pulmonary System (6 weeks)	S-4 GI/Hepatic and Renal System (6 weeks)	Vacation	S-5 Skin and Musculo-skeletal System (4 weeks)	S-6 Neurologic Systems (7 weeks)	Clinical problem-solving/OSCE	IS Mini Conference

The curriculum is partitioned into Modules, Days, Sessions, and Artifacts (see Figure 3). A module runs the entirety of the course, days are individually described on the calendar, sessions take place within each day and may have various artifacts. Students identify module requirements by accessing the Canvas Learning Management System (LMS) provided by the College of Medicine. Within the Canvas, the student is presented with module objectives via the syllabus, the assignment deadlines through the course summary, and finally the session objectives and artifacts by selecting the individual session information.

Linear Number	Year:	Course:	Session Name	Date:	Total Weeks of Course:	Week of Scheduled Class Within Course:	Day:	Time Scheduled (Min):	Date:	Total Weeks of Course:	Week of Scheduled Class Within Course:	Day:	Artifact:	Assigned / Recommended:	Modality:	Pages (#) / Slides (#) / Cases (Min) / Time (Min):
1	M2	BMS 6633 Cardiovascular and Pulmonary	Pharmacology overview, physiology and anatomy review SLM	14-Aug-17	8	1	Mon	30								
2									14-Aug-17	8	1	Mon	2017-08-10 Physiology Review SLM	A	PPT	13
3									14-Aug-17	8	1	Mon	2017-08-10 Overview of systems pharmacology SLM	A	PPT	11
4	M2	BMS 6633 Cardiovascular and Pulmonary	Module expectations	14-Aug-17	8	1	Mon	30								
5									14-Aug-17	8	1	Mon	2017-08-14 CVS Pulm Module Introduction and Expectations	A	PPT	38
6	M2	BMS 6633 Cardiovascular and Pulmonary	Introductin to CVS, clinical presentation & diagnosis	14-Aug-17	8	1	Mon	90								
7									14-Aug-17	8	1	Mon	2017-08-14 Introduction to cardiovascular disease signs and symptoms	A	PPT	49
16	M2	BMS 6633 Cardiovascular and Pulmonary	Introduction to diagnostic testing	14-Aug-17	8	1	Mon	30								
17									14-Aug-17	8	1	Mon	2014-08-14 CV Diagnostic Testing	A	PPT	25
21	M2	BMS 6633 Cardiovascular and Pulmonary	12 lead ECG introduction	14-Aug-17	8	1	Mon	60								

Figure 3: Data spreadsheet for artifact and associated time measurement

Information to fill the CRI section of the data spreadsheet will be gathered from the course summary section of the LMS to the session level. The CRI includes (column A) linear number used as a reference for all subsequent data collection, (column B) year, (column C) course, (column D) session name, (column E) date, (column F) total weeks of course, (column G) week of scheduled class within course, (column H) day, and (column I) time scheduled in minutes (see Table 4).

Table 4*Course Reference Information Sample*

A	B	C	D	E	F	G	H	I
Linear Number	Year	Course	Session Name	Date	Total Weeks of Course	Week of Scheduled Class within Course	Day	Time Scheduled (Min)
1	M2	BMS 6633 Cardiovascular and Pulmonary	Pharmacology overview, physiology, and anatomy review SLM	14-Aug-17	8	1	Mon	30
2								
3								
4	M2	BMS 6633 Cardiovascular and Pulmonary	Module expectations	14-Aug-17	8	1	Mon	30
5								
6	M2	BMS 6633 Cardiovascular and Pulmonary	Introduction to CVS, clinical presentation, and diagnosis	14-Aug-17	8	1	Mon	90
7								
16	M2	BMS 6633 Cardiovascular and Pulmonary	Introduction to diagnostic testing	14-Aug-17	8	1	Mon	30
17								
21	M2	BMS 6633 Cardiovascular and Pulmonary	12-lead ECG introduction	14-Aug-17	8	1	Mon	60

The SAI includes (column J) date, (column K) total weeks of course, (column L) week of scheduled class within course, (column M) day, (column N) artifact, (column O) assigned/recommended, (column P) modality, and (column Q) pages,

slides, cases, and time (see Table 5). Some data fields within the spreadsheet are duplicated, the duplication of data is for additional granulation of data for the potential of future analysis.

Table 5

Session Artifact Information

A	B	J	K	L	M	N	O	P	Q
Linear Number	Year	Date	Total Weeks of Course	Week of Schedule Class within Course	Day	Artifact	Assigned/ Recommended	Modality	Pages (#)/ Slides (#)/ Cases (Min)/ Time (Min)
1	M2								
2		14-Aug-17	8	1	Mon	2017-08-10 Physiology Review SLM	A	PPT	13
3		14-Aug-17	8	1	Mon	2017 Overview of systems pharmacology SLM	A	PPT	11
4	M2								
5		14-Aug-17	8	1	Mon	2017-08-14 CVS Pulm. Module Introduction and Expectations	A	PPT	38
6	M2								
7		14-Aug-17	8	1	Mon	2017-08-04 Introduction to cardiovascular disease signs and symptoms	A	PPT	49
16	M2								
17		14-Aug-17	8	1	Mon	2014-08-04 CVS Diagnostic Testing	A	PPT	25
21	M2								

The final section of the data gathering spreadsheet will include (column R) USCOM time calculations, (column S) study time calculations low, (column T) study time calculations high, (column U) USCOM versus study time low, and (column V) USCOM versus study time high (see Table 6). Objective time requirements for USCOM Time Calculation and Study Time Calculations (low and high) are included to identify variability in the time calculations between the two tools. The final two columns will represent the difference in objective time requirements between the USCOM policy and the student variability as expressed in the RICE CTE course workload estimator.

Table 6

Course Calculation Fields

R	S	T	U	V
UCF Time Calculation (Min)	Study Time Calculation Low (Min):	Study Time Calculation High (Min):	UCF vs. Study Time Low (R-S)	UCF vs. Study Time High (R-T)

Objective Workload Data

Objective workload is defined as the time required to complete all learning activities within a course of instruction (Kember, 2004). The USCOM *Out of Class Work Policy* and the RICE CTE Workload Estimator will be used to establish time for analysis.

USCOM Policy

The medical school curriculum includes assigned and recommended reading, case study presentations, assigned and recommended MS PPT-based self-learning modules, and either commercially produced or faculty-narrated videos. Time calculations associated with the

USCOM *Out of Class Work Policy* are made with the assumption an individual student does not require additional accommodations for learning differences. In other words, if a learner processes information at a different rate, this policy does not consider individual differences. Time calculations of the USCOM *Out of Class Work Policy* are determined according to the standard reading rate of five minutes per textbook page, one minute per non-narrated MS PPT slide, and the runtime of a narrated self-learning module. After calculations are determined, the USCOM *Out of Class Work Policy* will produce a single time estimate as a representation of objective workload.

USCOM *Out of Class Work Policy* will be calculated at the Module level then a mean identified for the module. Additionally, workload will then be calculated for scheduled days of instruction.

RICE CTE Course Workload Estimator

The RICE CTE course workload estimator data will produce a range of student objective workload from low to high to be used for data analysis. Materials required for the course modules will then be calculated using the RICE CTE course workload estimator (Rice University, 2019). Assigned and recommended reading materials will be calculated using the textbook density, with time range calculations of No New Concepts and Many New Concepts for difficulty, as well as Survey and Engage for Purpose. Presentation of case-based paper or digitally mediated scenarios are completed during scheduled mandatory class attendance, therefore, accounted for by classroom time in the workload calculation. MS PPT self-learning modules required an adjustment to methodology based on the density of the materials. Initial review of the MS PPT presentations in both print and the video self-learning module presentation

formats density which did not fit into any existing category of the RICE CTE Workload Estimator therefore, the density will be set to paperback with difficulty and purpose following the same range as for reading.

After calculations are determined, the RICE CTE will produce two-time estimations based on input variables. These two-time estimations will be calculated at the instructional day and calendar day levels then a mean identified for the RICE CTE Mean, stated as the RICE objective workload used for data comparison.

Subjective Workload Data

USCOM Perceived Workload Survey

The SPWS will be used as the subjective workload calculation (see Appendix A). Subjective workload is the combination of the demands placed on the student and the effect of these demands on the student's perception of academic and social requirements (Kember, 2004). The student perception of workload is administered at the end of every course and the USCOM requires mandatory completion by all students. The SPWS (Appendix A) is time coded and available to students for completion for the period of 7 calendar days via the LMS dashboard. SPWS data is anonymous and kept by USCOM student academic services. The SPWS is composed of thirteen questions distributed through four sections with an option for a fifth category used if required for course specific questions (e.g., textbook utility, live patient presentation). The four sections of the survey are (a) Module Organization and Content, (b) Assessment, (c) Affiliate and Volunteer Faculty and (c) Overall Comments.

The Module Organization and Content section contains Questions 1 through 5 concerning the learners' perception of content, course organization, teaching methods, curriculum materials, and self-directed learning opportunities as well as an open text field for course feedback. The answer format is a 5-point Likert scale ranging from Significantly Agree to Significantly Disagree. The Assessment section contains Question 6 through 8 concerning the learner's perception of formative and summative assessments as well as an open text field for course feedback. The answer format is a 5-point Likert scale ranging from Significantly Agree to Significantly Disagree. The Affiliate and Volunteer Faculty section contains Question 9 and is intended to assess presentations from guest lecturers. The Overall section contains Questions 10 through 13 concerning the learners' perception of workload requirements for the course and learner satisfaction. Question 12 and Question 13 of the Overall section are open text field for course feedback concerning strengths of the module and suggestions for improvement. Question 10 is a 5-point Likert scale for students' perception of workload with an answer format of Much to Light (MTL), Light (L), Significant but Manageable (SBM), Too High (TH), and Much to High (MTH). Question 11 concerns the learner's general satisfaction with the module as a whole. The answer format is a 5-point Likert scale ranging from Significantly Agree to Significantly Disagree. In this study, Questions 10, 11, and 12 were considered. Question 10 and 11 were descriptively analyzed to determine student's perception of the overall course workload and Question 12 was the basis of the content analysis regarding learner motivation.

Data Analysis

Process

To answer RQ1, all artifacts for the USCOM M2, excluding the P-2 continuous module were identified, recorded, and classified at the Course level. Three classifications were defined including: (a) PPT presentations, (b) reading, and (c) case presentation. Next, the artifacts were separated into assigned and recommended artifacts, classified using the same categories.

Assigned artifacts serve to identify variance in the objective workload as measured by the USCOM *Out of Class Work Policy* and the RICE CTE workload estimator for each course in M2. Next, descriptive comparison of USCOM, RICE CTE workload estimator instructional day, calendar day, were conducted.

To answer RQ2, the SPWS was de-identified and aggregated at the Course level by the USCOM academic services office and presented to the researcher for analysis. Data was then transferred to an MS Excel spreadsheet for analysis. Descriptive analysis were conducted as well as a content analysis for the open-ended question.

Content Analysis

A deductive content analysis utilizing the Keller's' ARCS Model for Motivation as the theme was employed using the framework method (Gale, et al., 2013). The framework method includes: (a) transcription, (b) familiarization, (c) coding, (d) working analytical framework, (e) framework application, (f) framework data input, and (g) data interpretation. The SPWS, specifically Question 12, assesses student satisfaction. De-identified surveys were provided for data analysis. Answers to Question 12 were transcribed and placed (copied/pasted) into a MS

Word document then the spell check function was used to assure proper spelling of all words. The spellchecked document was then screened using the “find” function using keywords (see Table 7) as described previously. Single sentences were then analyzed for context and included for content analysis.

Table 7*Keywords Used in Content Analysis*

Keywords						
Again	Days	Ever	Lifetime	Opportunity	Step	Time
Break	Duration	Just	Long	Point	Term	While
Date	Effort	Late	Once	Schedule	Then	Year

Note. Source: Power Thesaurus, www.powerthesaurus.org
<https://www.powerthesaurus.org/time/synonyms>

First, student responses to Question 12 were separated into individual sentences then transcribed into an MS Excel spreadsheet. The key words shown in Table 7 were searched and selected as potential entries for inclusion in the content analysis. Key word searches aided in the identification of sentences for inclusion. Next, the transcribed responses were read numerous times for familiarization with the content and context. Coders were selected and provided training using face-to-face instruction method and the instruction sheet (Appendix B). Coders were then asked to analyze the units of analysis and classify the sentences into the pre-established themes of Keller's ARCS model for Motivation (see Table 8).

Table 8*Content Analysis Rater Agreement*

Course	Question	Attention	Relevance	Confidence	Satisfaction
BMS 6632	85.23%	86.36%	90.91%	84.85%	80.30%
BMS 6633	88.69%	94.44%	90.48%	88.89%	80.95%
BMS 6634	89.22%	96.55%	87.36%	86.78%	87.36%
BMS 6635	91.84%	98.61%	82.64%	89.58%	96.53%
BMS 6636	85.61%	93.94%	86.36%	83.33%	77.27%
M2 Year	88.89%	95.14%	87.15%	86.98%	84.48%

Coders were provided a spreadsheet with each of the individual courses and their associated single sentence comments for completion. Instructions directed the Coder to read each statement and decide if the learner was expressing positive or negative feelings about their Attention, Relevance, Confidence, or Satisfaction concerning the course content. Each statement could be classified in multiple positive or negative ARCS domains. The Coder then annotated the associated spreadsheet with their answer. When completed with all coding, the sheets were collected, and percentage of agreement was calculated at the Question, Module, Course, and Year level. A frequency of each theme was calculated and recorded. Percentages of agreement between the Coders at the Question level as well as association with the ARCS framework is indicated in Table 8.

To answer RQ3, results from RQ1 were evaluated to identify the USCOM second-year course with the highest and lowest instructional day objective workload as per the USCOM Policy. After course identification, a deep comparison was conducted to identify the similarities and differences between the courses. Factors for analysis include the perceived manageability of the course workload, the cumulative learner motivation as determined by the content analysis, and the time investment for completing the course. RQ3 will include all assigned and recommended artifacts calculated for both the USCOM *Out of Class Work Policy* and the RICE CTE workload estimator for comprehensive comparison. Additionally, content analysis will include classification of the module learning objective using Bloom's taxonomy.

Content analysis will be conducted using the learning objectives from the courses. Learning objectives will be categorized using the same framework methodology but associated

with Bloom's taxonomy (Anderson, et al., 2001). A learning objective that does not specifically have a word mentioned in Table 9 will be evaluated for context and a domain assigned.

Table 9

Bloom's Taxonomy of Verbs

Bloom's Taxonomy					
Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
acquire	conclude	apply	analyze	arrange	argue
define	describe	calculate	classify	assemble	appraise
identify	differentiate	develop	compare	collect	assess
know	discuss	demonstrate	contrast	combine	choose
list	draw	dramatize	categorize	compose	compare
memorize	explain	employ	deduce	construct	conclude
name	express	exhibit	detect	create	consider
recall	identify	illustrate	differentiate	design	criticize
record	illustrate	interpret	discover	derive	decide
relate	infer	operate	discriminate	develop	deduce
repeat	interpret	organize	dissect	document	estimate
recognize	locate	practice	examine	formulate	evaluate
	recognize	relate	experiment	generalize	infer
	report	restructure	inquire	invent	judge
	restate	show	inspect	modify	measure
	review	translate	investigate	organize	rate
	represent	use	probe	originate	select
			scrutinize	plan	validate
			separate	predict	value
			survey	prepare	
				produce	
				propose	
				tell	
				relate	
				set up	
				write	

Threats to Validity

Internal Validity

The primary threats to internal validity were related to content analysis concerning the ARCS framework. Though content analysis has been used in healthcare specific fields for perceptions of curriculum development (Rosen, et al., 2019), the ARCS framework has not been used previously for evaluation of student's perception of workload. The Coders were provided training concerning the use of the content analysis and the use of the ARCS framework for evaluation (Appendix B). To eliminate the potential for excess variance in coder rating, only the main categories of the ARCS framework were employed for content analysis.

Summary

In this chapter, the methodology for the proposed study was described, including descriptive analysis and content analysis. The variables instrumentation, statistical procedures, and analysis were presented by research questions. Chapter Four will present the findings.

CHAPTER FOUR: FINDINGS

Introduction

The purpose of this study was to explore the M2 level of medical education at one USCOM in relationship to time, students' perception of workload, student motivation, and potential cognitive load. Time was determined according to the USCOM *Out of Class Work Policy*, and the RICE CTE course workload estimator. Further, a content analysis was conducted of students' motivation for learning according to Keller's Model for Motivation and the learning objectives were examined. As data to be analyzed was presented in Chapter 3, Chapter 4 will present the results of data analysis in RQ order.

RQ1 Findings

RQ1: In what ways does the objective workload differ based on the calculation of the approved USCOM *Out of Class Work Policy* and the RICE CTW workload estimator for assigned activities between the USCOM M2 courses?

The curriculum structure includes cognitive, psychomotor, and affective domain components. The material represented in this study are strictly the workload associated with the cognitive components of the required coursework for the M2 curriculum at one institution. The study does not account for the Practice of Medicine (P-2) course workload, which runs continuously through the second year of the medical school curriculum. Moreover, the study does not account for alignment of the formative or summative assessments with content provided within any of the M2 curriculum courses.

First, all artifacts for M2 were identified. The curriculum includes assigned and recommended artifacts. Typically, the quantity of artifacts translated to the amount of student workload. USCOM *Out of Class Work Policy* classifies artifacts as assigned or recommended. Assigned artifacts require student completion whereas recommended artifacts are additional information for the learner to consider. Only assigned artifacts were calculated to answer RQ1. Table 10 represents the total amount of objective workload for assigned artifacts using both the USCOM *Out of Class Work Policy* and the RICE CTE Course Workload Estimator at the Module level.

Table 10

Assigned Artifact Calculations

Course	USCOM Policy Calculations (Hours)	RICE CTE Calculation (Low Hours)	RICE CTE Calculations (High, Hours)
BMS 6632	54	46	323
BMS 6633	64	55	396
BMS 6634	67	52	253
BMS 6635	36	31	207
BMS 6636	74	63	444
M2	295	247	1623

The USCOM *Out of Class Work Policy* and the calculation for the RICE CTE Low are similar in objective workload hourly requirement at the Course level with an average difference of 9.6 hours between all courses in M2. The RICE CTE Low calculations assumes materials for the course included no new concepts for the learner and minimal requirement for application. In contrast, the RICE CTE High calculations assumes materials included many new concepts with a requirement for practical application and synthesis of the information.

The USCOM *Out of Class Work Policy*

The number of artifacts used to calculate the objective workload for each course are presented in Figure 4. These artifacts included reading assignments, MS PPT presentations, and case studies. The USCOM *Out of Class Workload Policy* was used to assign an objective workload time. Course artifacts ranged in number from 48 to 133. Consistently throughout all modules, required reading assignments are significantly lower in quantity than the PPT assignments. Additionally, experiential learning through case presentations were conducted in the allotted class time and were not considered in the out of class workload calculations. Although not counted, course BMS 6634 contains the highest number of cases as well as the highest number of reading assignments. Course BMS 6636, Brain and Behavior, contained the highest number of artifacts inclusive of the highest number of PPT/SLMs.

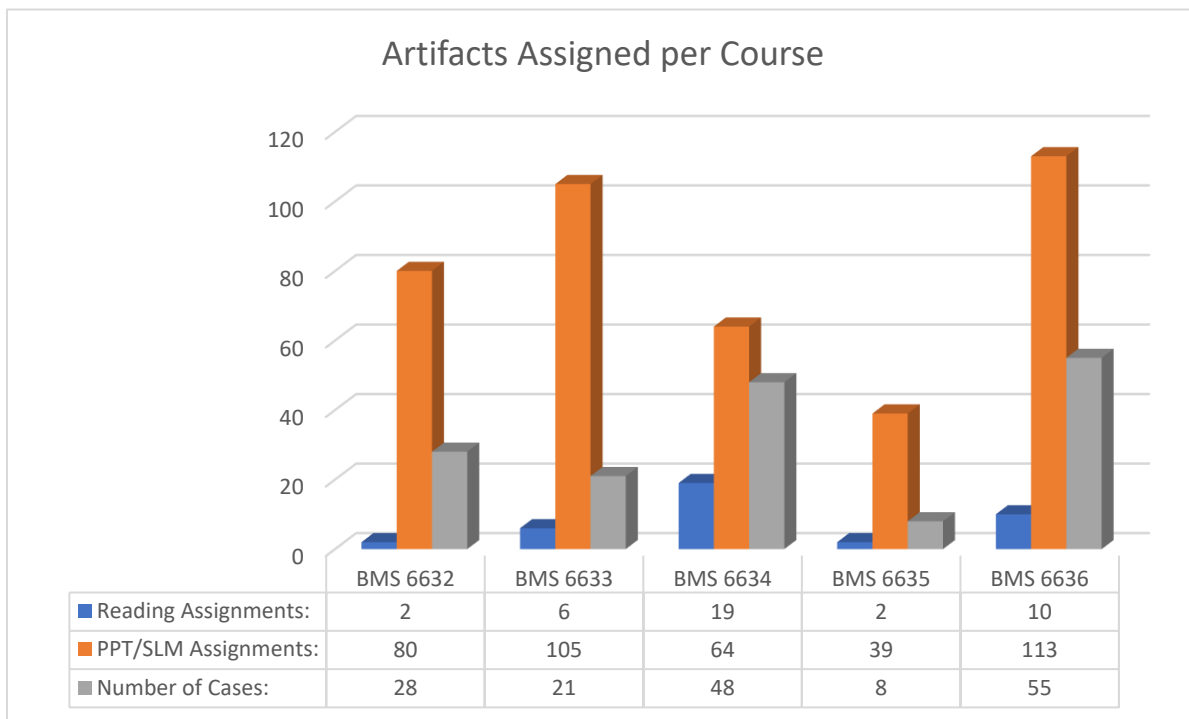


Figure 4: Assigned Artifacts by Modality per Course

USCOM M2 year includes five modules consisting of instructional days and calendar days. Instructional days are defined by a scheduled course offering within the LMS. Calendar days are defined as the number of days from the first to the last scheduled instructional day. USCOM instructional versus calendar days are represented in Figure 5. Course BMS 6636, Brain and Behavior, has the most instructional (32) and calendar (47) days, whereas BMS 6635 has the least amount of instructional and calendar days of the five courses represented in the second year of medical school courses. The difference between instructional days and calendars days are related to academic scheduling and holidays throughout the calendar year. With the increased calendar days, there is a possibility the student will have additional time to engage or reflect on the materials presented throughout the course or year.

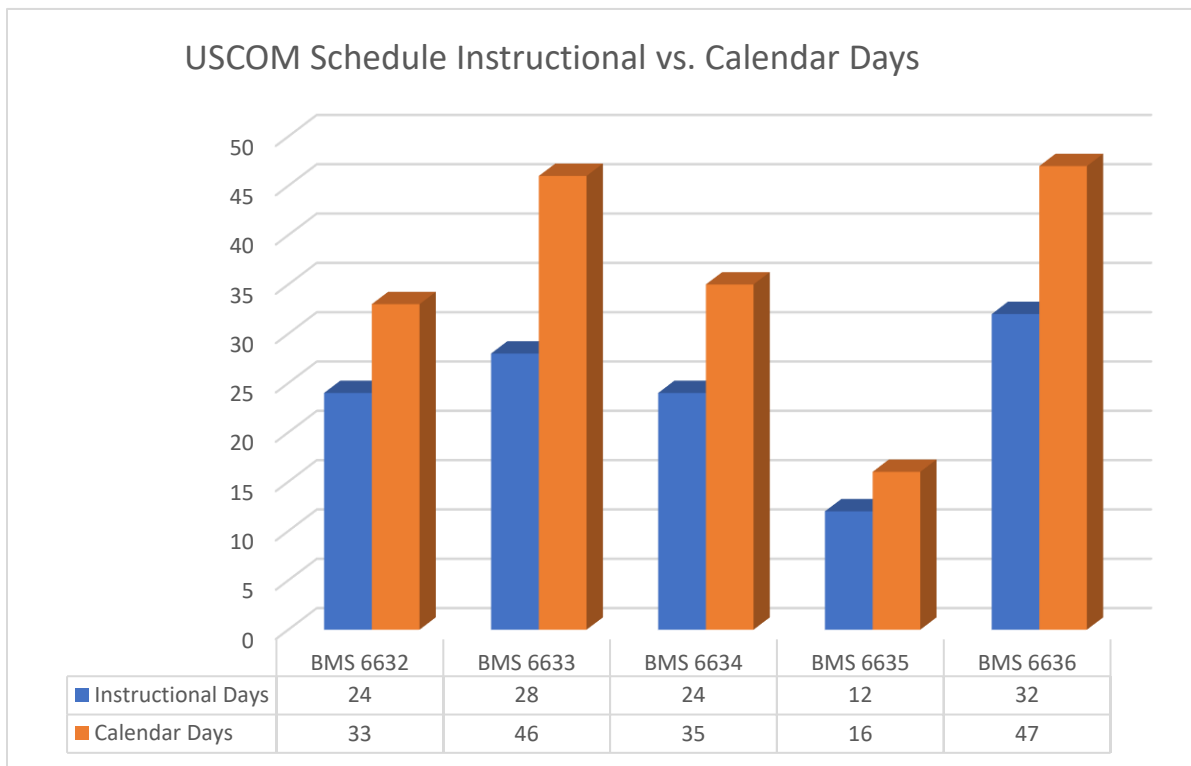


Figure 5: USCOM Instructional versus Calendar Days

Next, the USCOM *Out of Class Workload Policy* was compared to the RICE CTE workload estimator by instructional day and calendar day. Calculations of objective workload applying both the USCOM *Out of Class Workload Policy* and the RICE CTE workload estimator at the instructional day and calendar day level are presented in Figure 6 and Figure 7. The results are comparatively similar for both policy calculations with course BMS 6635, Skin and Musculoskeletal System, required the most hours of the instructional day (2.99) and calendar day (2.24) according to the *USCOM Out of Class Workload Policy*.

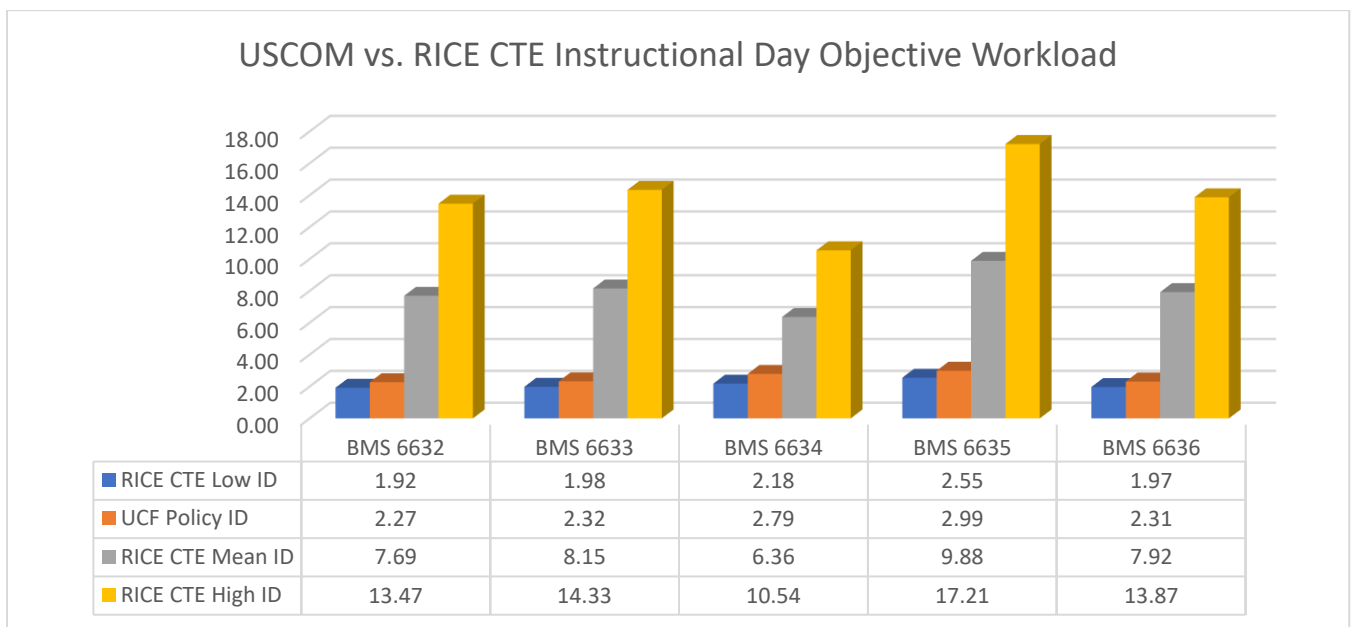


Figure 6: USCOM versus RICE CTE Instructional Day Objective Workload in Hours per Instructional Day (ID)

The courses of the M2 year are sequential by numbering convention using an organ system model of instruction. When evaluating the M2-year workload, the greatest workload demand appears to take place during the end of the calendar year. The calendar year schedule indicates BMS 6632, 6633, and 6634 take place prior to the holiday break in December.

Calculations of average hours indicates average daily objective workload of 2.46 hours prior to the holiday break and 2.65 hours and after the holiday break

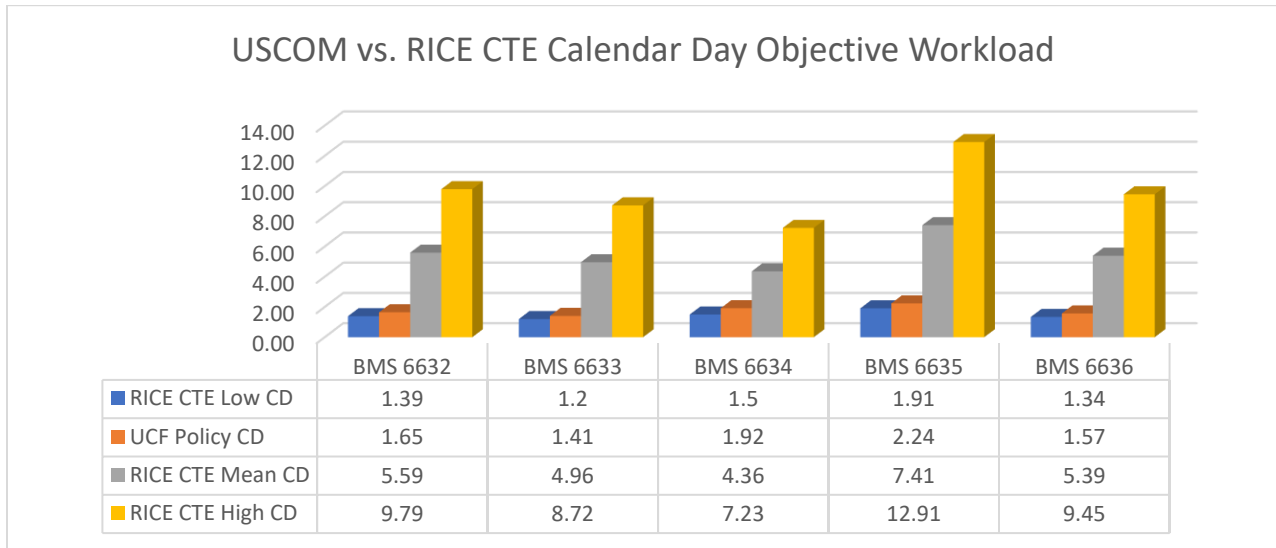


Figure 7: USCOM versus RICE CTE Calendar Day Objective Workload in Hours per Calendar Day (CD)

The courses differed in calendar day, instructional day, artifacts, as well as the reading time to complete artifacts as measured by the USCOM workload calculations and the RICE CTE workload estimator. Course BMS 6635 indicates the largest differences in all categories analyzed. This course has the highest objective workload at the instructional day and calendar day level with the application of both policies. Conversely, it has the smallest number of instructional and calendar days as well as assigned artifacts.

Students Perception of Workload and Satisfaction

Student perceptions of workload represent two varying types of answers: one a statement of subjective workload and one a statement of satisfaction. Student responses for subjective workload (Question 10) are represented in Table 11 and responses for satisfaction with the

course (Question 11) are represented in Table 12. Course BMS 6632 represent the highest mean score for student's perception of workload and statement of satisfaction.

Table 11

Students' Workload Perceptions

Q 10	Much too Low	Low	Significant but Manageable	Too High	Much to High	N	Mean
BMS 6632	1	7	91	15	2	116	2.76
BMS 6633	0	2	63	29	25	119	2.32
BMS 6634	1	4	82	18	2	107	2.74
BMS 6635	1	4	88	20	3	116	2.72
BMS 6636	1	2	70	28	15	116	2.47

The results of the workload perceptions indicate the highest rating for the *Significant but Manageable* in all courses. However, courses BMS 6633 and 6636 are rated as having *Much Too High* workload disproportionately than the other courses in the M2 year. Even when considering differences in the number of students between courses BMS 6633 and BMS 6636 ($N = 3$); the students' perceptions of *Too High* and *Much Too High* would still be disproportionately similar.

Table 12

Students' Satisfaction

Q 11	Significantly Agree	Agree	Neither Agree nor Disagree	Disagree	Significantly Disagree	N	Mean
BMS 6632	40	56	16	2	1	115	4.15
BMS 6633	36	61	15	5	2	119	4.04
BMS 6634	24	48	20	12	3	107	3.73
BMS 6635	38	56	16	6	0	116	4.09
BMS 6636	23	41	29	14	8	115	3.5

Student rated their satisfaction predominantly in the *Agree* category for all courses. Course BMS 6636 indicate a large amount of variance in student satisfaction. Comparison of students' workload perception and students' satisfaction for course BMS 6636 indicate a 25% ambivalence to the learner's satisfaction as well as a higher rating of *Too High* and *Much Too High* perceptions of workload. The range of ambivalence for all course in the M2 year is 13% to 25%.

RQ1 identified differences in module length for objective workload using both the USCOM *Out of Class Workload Policy* and the RICE CTE workload estimator. Student satisfaction and perceptions of workload were explored. Interestingly, courses BMS 6633 and BMS 6636 indicate a disproportionate perception of workload at the *Too High* and *Much Too High* levels while simultaneously indicating the highest level of ambivalence when expressing satisfaction. Additionally, these two courses fall in the middle of the objective workload calculations at the instructional and calendar day levels.

RQ2 Findings

Next, a content analysis was conducted of learners' perceptions of the workload for each course in the M2 curriculum. The SPWS provided the learners' the opportunity to express their perceptions of workload via an open text field on the survey. Students answered an open-ended question related to the course. These comments were the analyzed through content analysis.

RQ2: In what ways, if any, did students express their motivation of learning for the USCOM M2 according to Keller's ARCS Model of Motivation (Attention, Relevance, Confidence, Satisfaction)?

A single sentence or statement was the unit of study for analysis. Totals for responses per course and for the module are represented in Table 13. The total student responses to perceptions of workload were separated into individual sentences then screened for keywords, resulting in 29% ($N = 340$) sentences for analysis. These sentences were read in context to determine relevance to objective or subjective workload. The remaining sentences were included for content analysis.

Table 13

Content Analysis Inclusion Results

Course	Total Responses	Individual Sentences	Keyword Inclusion	Statements for Inclusion in the Content Analysis
BMS 6632	107	246	54 (22%)	11 (10%)
BMS 6633	116	256	82 (32%)	21 (18%)
BMS 6634	101	192	52 (27%)	29 (28%)
BMS 6635	108	214	70 (33%)	24 (22%)
BMS 6636	111	261	82 (31%)	11 (10%)
Totals	543	1169	340 (29%)	96 (18%)

A total of 18% ($N = 96$) of individual sentences of the initial 543 considered were analyzed through content analysis. Course BMS 6634 received the lowest number of total initial responses related to students' perception of workload yet the highest number of individual sentences were retained for inclusion in the content analysis. Inversely, course BMS 6636 received the highest total responses and tied with course BMS 6632 for the fewest statement inclusion after content analysis.

A single sentence or statement was the unit of study and it could be assigned to multiple ARCS domains based on the Coder's perception of learner intent. For instance, one student

response stated, “Between the didactic lectures and hands-on activities there was plenty of time to learn major concepts as well as opportunities to apply the concepts.” This sentence was cited as an expression of attention as well as satisfaction within the ARCS framework. Results classified by positive, positive and negative, and negative are presented in Table 14.

Table 14

Positive, Positive and Negative, and Negative Comment Classification

Course	Positive	Positive/Negative	Negative
BMS 6632	9	2	0
BMS 6633	13	7	1
BMS 6634	27	2	0
BMS 6635	23	1	0
BMS 6636	11	3	0

Course BMS 6634 included the largest number of sentences for inclusion in the content analysis. Course BMS 6633 was the course with the largest number of positive/negative comments as well as the only course with a purely negative comments included in the content analysis. The following describes the results of content analysis in course order of M2 curriculum.

Course BMS 6632

Eleven responses were included in the content analysis (see Figure 8). Nine responses indicated positive motivation while two statements included both positive and negative motivation. Relevance and Confidence were the major motivational factors identified for this course.

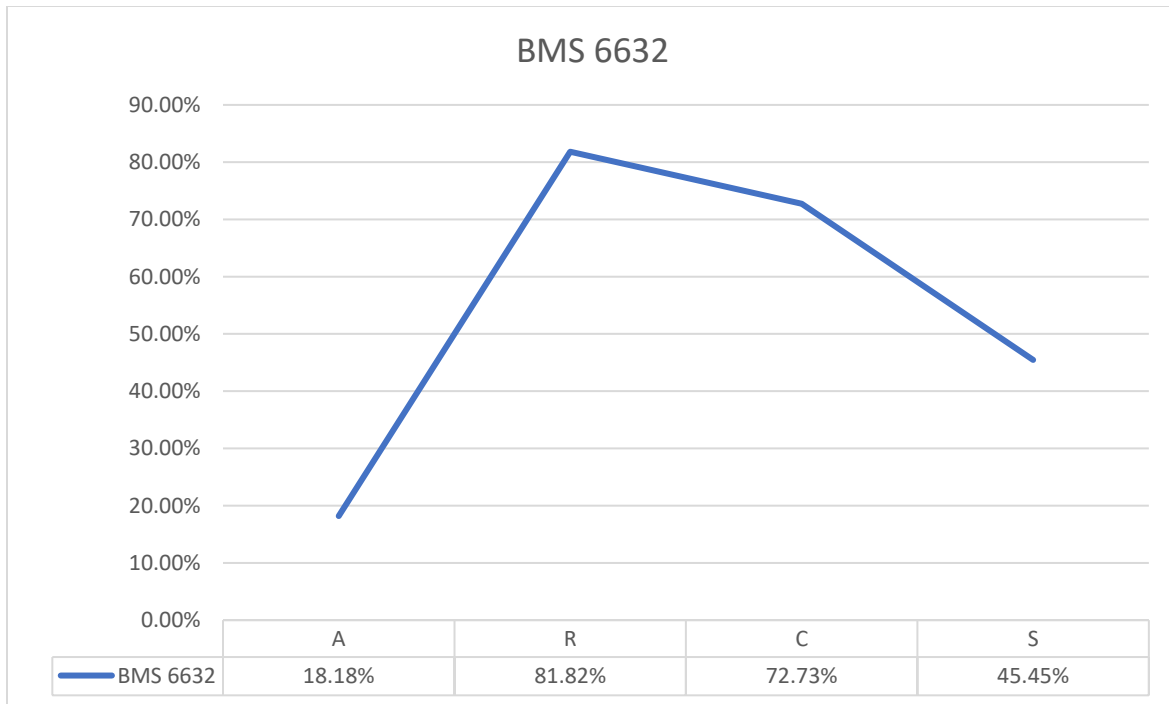


Figure 8: BMS 6632 ARCS Results

The learners expressed positive attributes of the content organization, sequencing of instruction, and variability of instructional materials. The comments with responses coded as both positive and negative related to the Attention and Satisfaction domains. Some students expressed difficulty in associating the course materials to self-directed study efforts, while others indicated the lack of time for mastery of course content. Examples of positive and negative statements associated with the ARCS framework are listed in Table 15.

Table 15*BMS 6632 Positive and Negative Unit of Study Comments*

Domain	Positive Comments
A	I thought that XXXXX went out of XXXXX way to make this topic a more manageable and relatable topic by having a real placenta and pointing out the anatomy directly.
R	I really liked the organization of the module and think that it provided us with ample time to really study and understand all the concepts.
C	I thought that the cases/pre-case quizzes helped me apply and master the material, while staying on top of the lectures.
S	There were heavy weeks, but they were usually followed by days that could be used to get caught up.
Positive/Negative Comment of Interest:	
C and S	While in lecture, I found the material manageable, however, I found reviewing the material outside of lecture to be difficult.

Course BMS 6633

Twenty-one responses were included in the content analysis (Figure 9). Fourteen responses were coded as positive motivation, six responses were coded with both positive/negative motivation, and one response was coded as negative motivation. Confidence and Relevance were the highest motivational factors for this course.

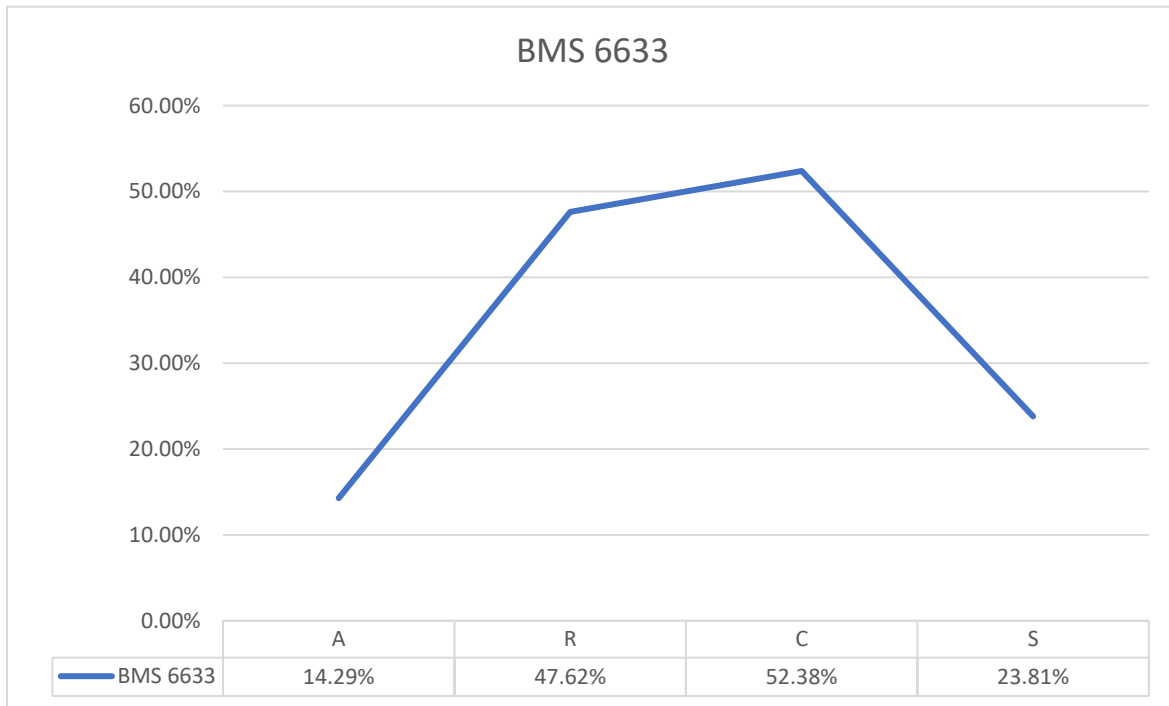


Figure 9: BMS 6633 ARCS Results

Major benefits as expressed by the learners included variability of instructional strategy (simulation events, case presentations, etc.) as well as faculty association of “high yield” or relevant information to Step I examination preparation. The main theme in diminished motivation for this course was expressed as a lack of time based on hurricane preparation. Examples of positive, positive/negative, and negative statements associated with the ARCS framework are listed in Table 16.

Table 16*BMS 6633 Positive and Negative Unit of Study Comments*

Positive Comments	
A	For the most part, the cases were helpful to reinforce the material, but they were too lengthy for the allotted time making them less beneficial since groups just rushed through them to finish in time.
R	The weekly quizzes really motivated me to stay updated with the material.
C and S	This sequence made a lot of sense and helped me understand rather than just memorize the material.
Positive/Negative Comment of Interest	
A and S	I would encourage faculty to add more of those experiences because they helped to reinforce and solidify concepts that we had learned that week.
R	The module itself was well organized and presented in a good order, the only issue that made it a very difficult time management module was the interruption by hurricane Irma.
C	I am disappointed that the compressed hurricane schedule did not allow time for additional simulations, because they were incredibly helpful, engaging, and fun!
Negative Comment of Interest	
C and S	However, it was very overwhelming when so much material was presented within the week and a half leading up to the module, with so many other cardiology concepts to review as well.

Course BMS 6634

Twenty-nine responses were included in the content analysis (see Figure 10) Twenty-seven responses were coded as positive motivation and two responses were coded a positive/negative motivation. Confidence was identified as the highest motivational factor for the learners.

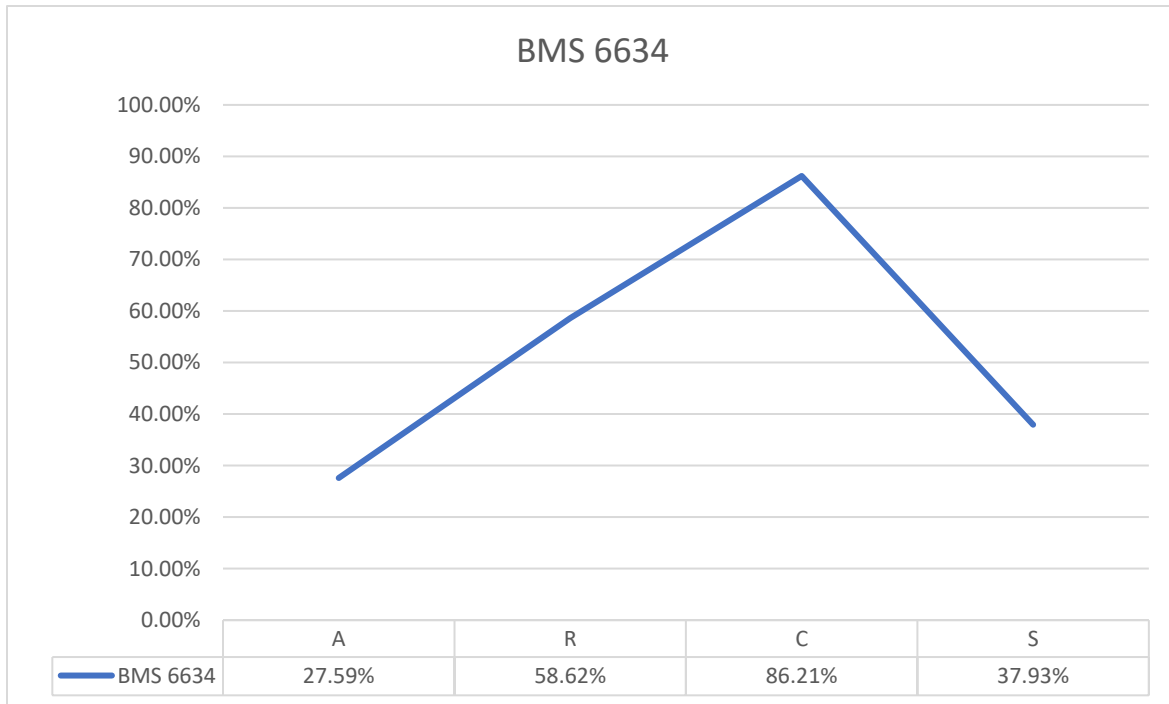


Figure 10: BMS 6634 ARCS Results

Major benefits as expressed by the learners included variability of instructional strategy (application exercises) and a reduction of mandatory courses. The positive/negative comment noted for this course was the satisfaction associated with the faculty version of artifacts and the debrief methods used after in class case presentations. Examples of positive, positive/negative statements associated with the ARCS framework are listed in Table 17.

Table 17

BMS 6634 Positive and Negative Unit of Study Comments

Domain	Positive Comments
A and R	I attribute that to a number of factors, but one that is notable and distinct for this module is likely the amount of extra time that was allowed for by reducing the number of mandatory sessions through the use of the application exercises.
C and S	I am happy that the application exercises were not mandatory, since I was able to do them in a much more effective and timely manner on my own.
Positive/Negative Comment of Interest	
S	The faculty versions of the cases are helpful to review the content; however, the verbal debrief where we review the cases immediately after are not helpful to me at all.

Course BMS 6635

Twenty-four responses were included in the content analysis (see Figure 11). Twenty-three responses were coded as positive motivation and one response were coded a positive/negative motivation. Confidence and Relevance were identified as the highest motivational factors for learners.

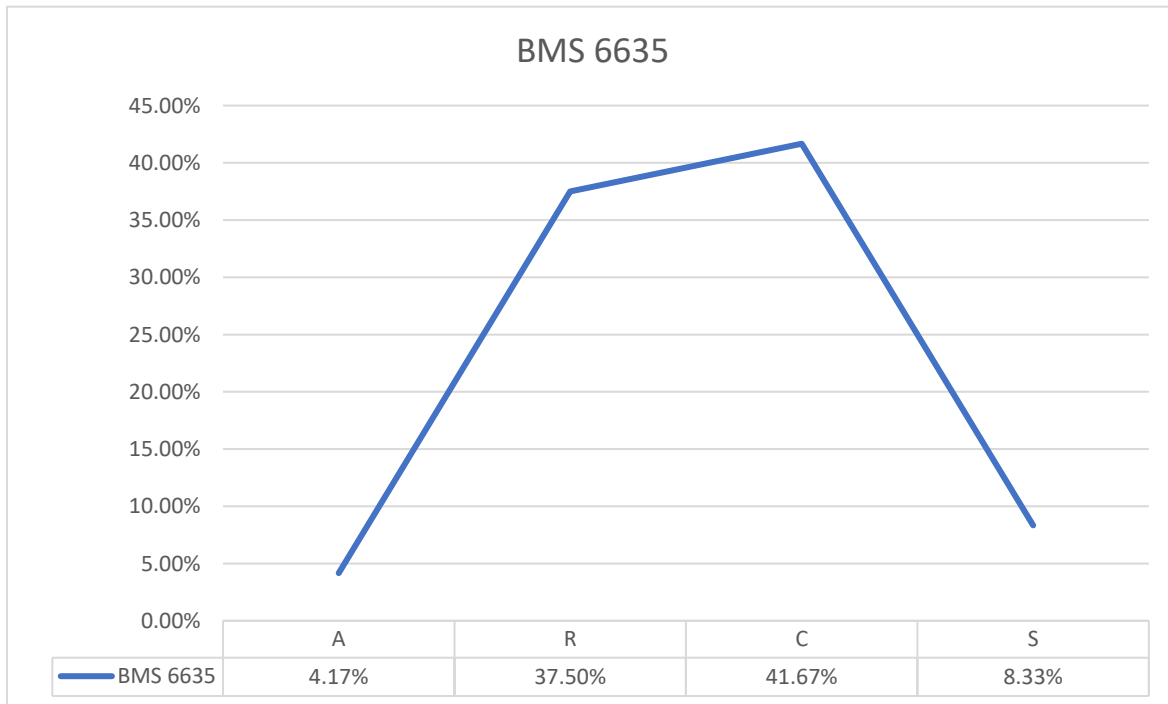


Figure 11: BMS 6635 ARCS Results

Major benefits as expressed by the learners included instructional sequencing, ample time for self-directed learning, and a reduction of mandatory class attendance. The positive/negative comment is questionable as to its classification as described by the Coder. Based on the content of the response, this comment appears to be more of an explanation of the student's rationale for the student's rating of the workload rather than an assessment of their perceptions of workload. Therefore, the comment was retained for coding purposes. Examples of positive and negative statements associated with the ARCS framework are listed in Table 18.

Table 18*BMS 6635 Positive and Negative Unit of Study Comments*

Domain	Positive Comments
A	The cases and TBL activities were appropriate for the time given so it didn't feel like my group was struggling to finish or finishing early and waiting which happened in most other modules.
R	I benefit from having the time to read Robbins and to look things up on UpToDate while studying and watching lectures online, and I was able to do that during this module.
C	I believe I had adequate time to prepare for the exam.
S	I really appreciated having a little bit extra time (compared to other modules) for self-study.
Positive/Negative Comment of Interest	
C	That is the only reason that I put "light" for workload; it was not a truly light module, but I felt that I had more than enough time to study and master the material.

Course BMS 6636

Eleven responses were included in the content analysis (see Figure 12). Eight responses were coded as positive motivation and three responses were coded a positive/negative motivation. Relevance and Confidence were identified as the highest motivational factors for learners.

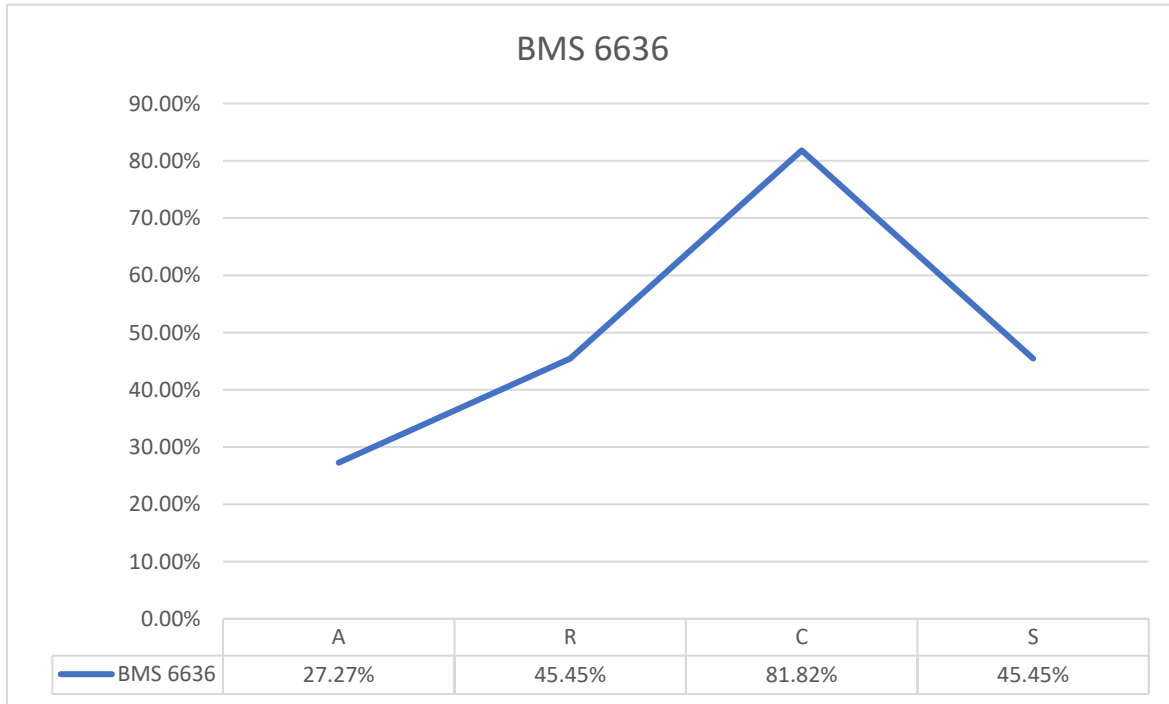


Figure 12: BMS 6636 ARCS Results

Major benefits as expressed by the learners included a focus on high-yield information for test preparation, organization of materials, and sufficient time allotted for self-directed learning efforts. Positive/negative comments focused primarily on the length of cases presentations during allotted classroom time. Examples of positive and negative statements are listed in Table 19.

Table 19

BMS 6636 Positive and Negative Unit of Study Comments

Domain	Positive Comments
A	Additionally, the faculty offering opportunities such as the Harvey session helped with mastery of the material and gave students time to ask questions over material they did not understand.
R, C, and S	The Cardio/Pulm module has prepared me very extensively for similar content on the USMLE Step 1 exam.
Positive/Negative Comment of Interest	
R and S	For the most part, the cases were helpful to reinforce the material, but they were too lengthy for the allotted time making them less beneficial since groups just rushed through them to finish in time.

M2 ARCS Perception

The prior examples of student comments are representative coded data within the ARCS framework. Presented below are the percentages of sentences mapped to the ARCS framework at Course level for the M2 year (Figure 13).

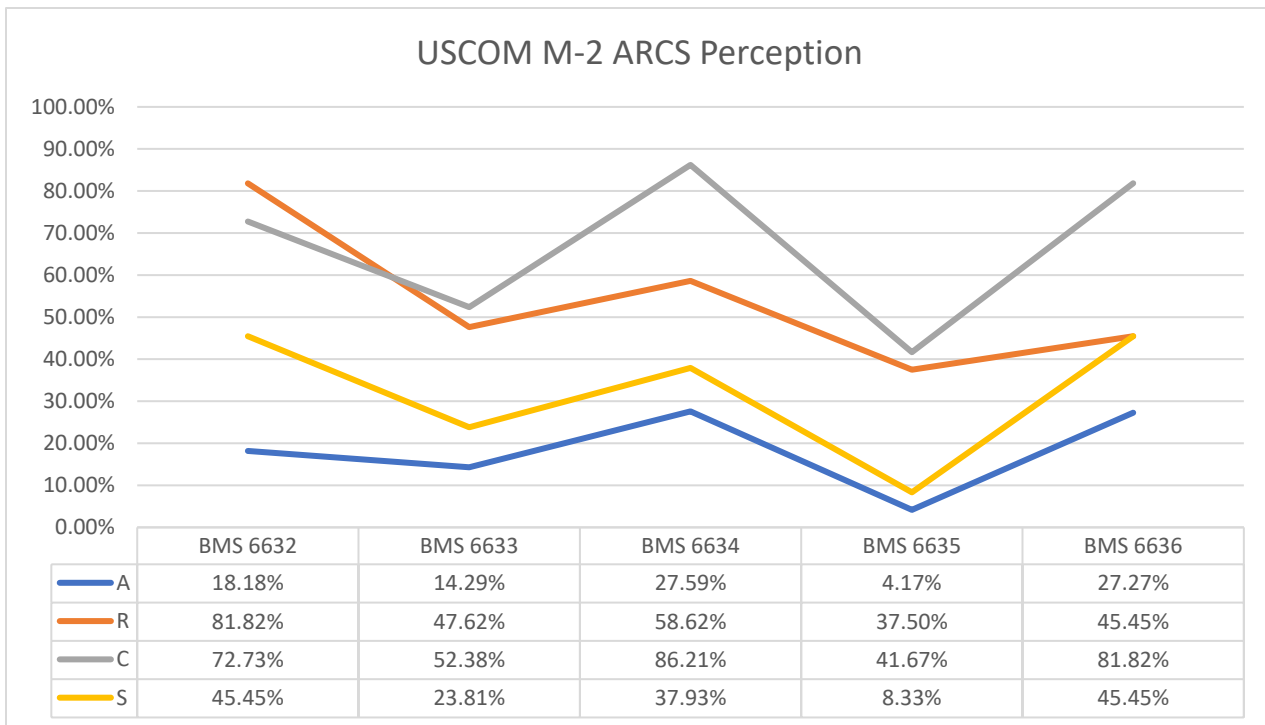


Figure 13: M2 ARCS Comparison

Based on the findings for RQ2, students expressed increased motivation associated with Attention domain when the instructional format includes multiple modalities, practical application of cognitive skills, team-based learning, and a reduction in mandatory class attendance. Module organization, focused formative assessments designed in the same manner as Step 1, and additional learning resources (UptoDate, Inc.) were cited as increasing the domain of Relevance. Confidence and Satisfaction were both enhanced when self-directed learning opportunities were presented to the learner.

Most comments coded were attributed to positive motivation, but positive/negative motivation was expressed by the learners in all domains of the ARCS framework. The positive/negative motivational comments generally are the inverse of the positive motivational comments. Learners indicated less motivation for the course due to schedule compression, perceptions of inadequate free time for self-directed learning, or lengthy case presentations. Additionally, multiple comments were coded as positive/negative motivation due to the uncontrollable nature of natural disaster, which required the schedule to be compressed.

The results from RQ1 and the results from RQ2 were compared to identify an association between the USCOM *Out of Class Workload Policy* calculations at the instructional or calendar day level and students' perception of workload as associated with the ARCS framework. Association of the descriptive data in rank order is represented in Table 20.

Table 20*Content Analysis Findings*

Sequential	Highest ID Course:	Highest CD Course:	Content Analysis Highest Attention:	Content Analysis Highest Relevance:	Content Analysis Highest Confidence:	Content Analysis Highest Satisfaction:
1	BMS 6635	BMS 6635	BMS 6634	BMS 6632	BMS 6634	BMS 6632
2	BMS 6634	BMS 6634	BMS 6636	BMS 6634	BMS 6636	BMS 6636
3	BMS 6633	BMS 6632	BMS 6632	BMS 6633	BMS 6632	BMS 6634
4	BMS 6636	BMS 6636	BMS 6633	BMS 6636	BMS 6633	BMS 6633
5	BMS 6632	BMS 6633	BMS 6635	BMS 6635	BMS 6635	BMS 6635

Course BMS 6635 has the highest objective workload at the instructional day and calendar day levels. The course with the lowest instructional day objective workload is BMS 6632 and the course with the lowest calendar day objective workload is BMS 6633. Comparing the instructional and calendar day objective workload to the ARCS framework reveals the course with the lowest instructional day objective workload (BMS 6632) was coded as being the most relevant and satisfying course for learner motivation. Inversely, the course with the highest instructional and calendar day objective workload (BMS 6635) was coded as being the least motivational course in all domains of the ARCS framework. Next, RQ3 will explore course BMS 6635 and course BMS 6632 to identify differences in course content.

RQ3 Findings

RQ3: How does the course with the highest objective UCFCOM workload at the instructional day level differ from the course with the lowest objective workload?

The results of RQ1 identified the course with the highest instructional day objective workload as BMS 6635 and the course with the lowest objective workload as BMS 6632. Disciplinary content for BMS 6635 is Skin and Musculoskeletal System. The course commences in January of the M2 calendar year and includes 16 calendar days of which 12 are instructional days. Disciplinary content of BMS 6632 is Endocrine and Reproductive Systems. The course commences in October of the M2 calendar year and includes 33 calendar days of which 24 are instructional days. Comparisons between the courses will identify (a) assigned and recommended artifacts, (b) modalities of artifacts, (c) objective workload calculations for assigned and recommended artifacts, (d) objective workload for instructional and calendar days, (e) total learning objectives, and (f) learning objective classification.

Assigned and Recommended Artifacts Comparison

The comparison of course BMS 6635 and course BMS 6632 started with the total number of assigned and recommended artifacts available to the learner through the LMS. assigned and recommended artifacts for course BMS 6635 and course BMS 6632 are represented in Figure 14. Course BMS 6635 lists 50 artifacts as assigned and 41 artifacts as recommended while course BMS 6632 lists 110 artifacts assigned and 70 artifacts recommended.

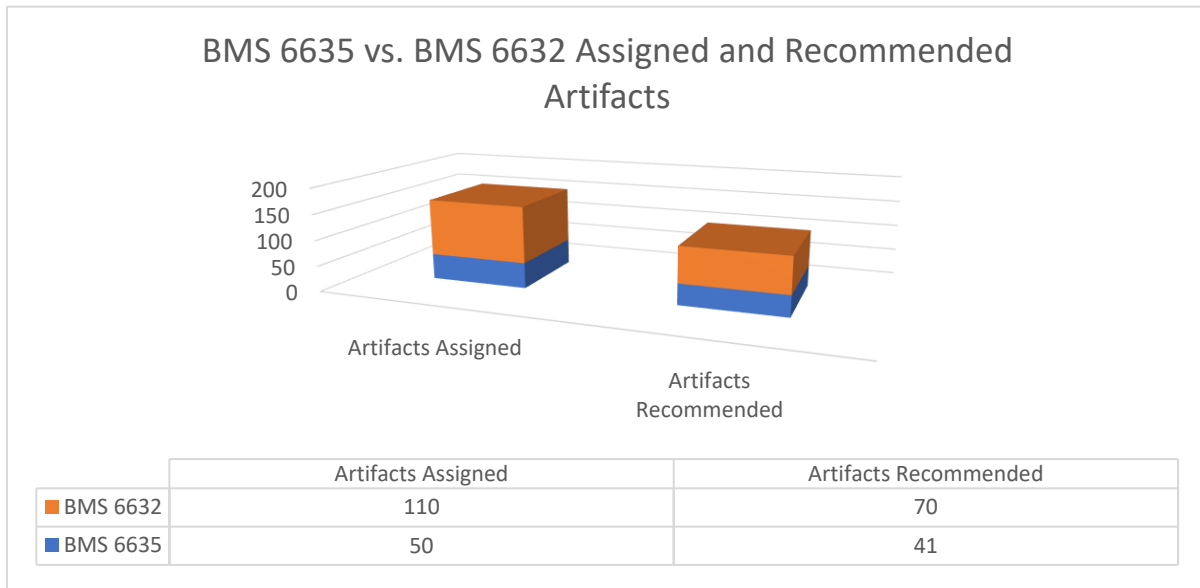


Figure 14: Assigned and Recommended Artifacts for BMS 6635 and BMS 6632

The addition of the recommended artifacts indicate 91 total artifacts for course BMS 6635 and 180 total artifacts for course BMS 6632. If the learner chooses to complete all artifacts reported in the LMS, the additional recommended artifacts increase the objective workload by 82% and 63% respectively. Time calculations for the additional recommended artifacts will be presented in the next section.

Objective Workload Calculations

Calculation using the UCOM *Out of Class Workload Policy* for the combination of assigned and recommended artifacts were completed indicating a significant increased objective workload at the Course level. Course BMS 6635 and course BMS 6632 assigned and recommended artifact totals are represented in Figure 15.

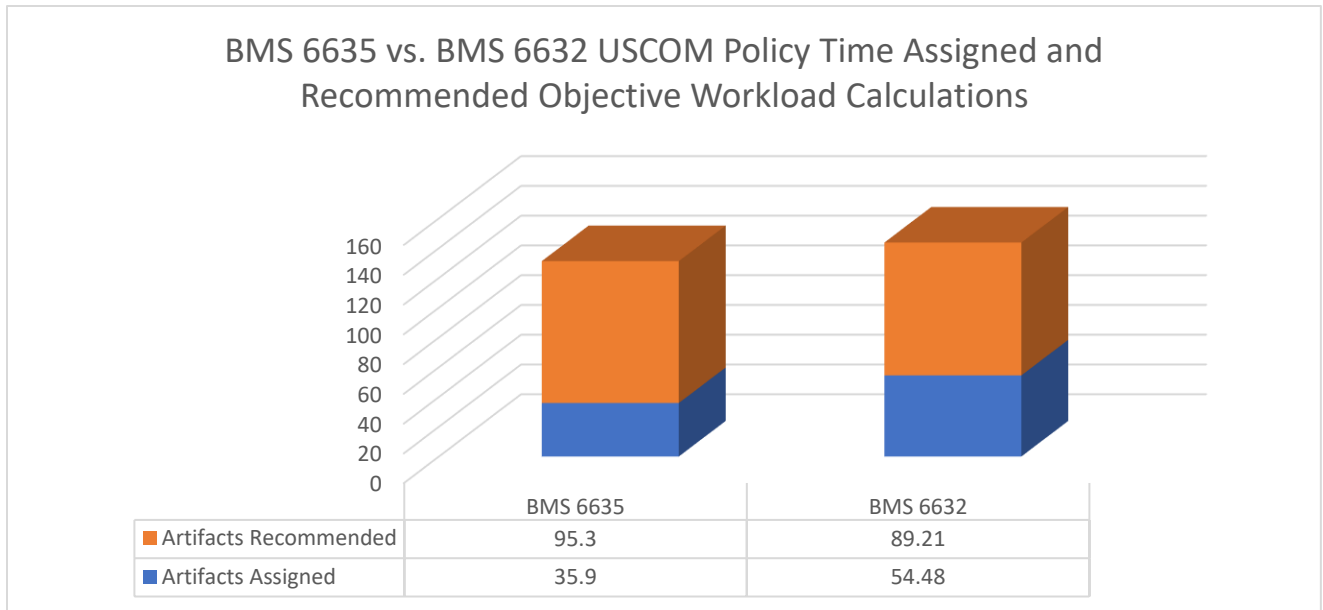


Figure 15: Assigned and Recommended Objective Workload (Hours) for BMS 6635 and BMS 6632

Course BMS 6635 recommended artifacts increase the objective workload to a total module objective workload of 131.2 hours. Course BMS 6632 recommended artifacts increase the objective workload to a total module objective workload of 143.69 hours. As simple numbers, the calculations of additional objective workload appear minor. Unfortunately, when identified as percentages of increased objective workload at the Module level, course BMS 6635 assigned and recommended artifacts calculate to a 265% increase in overall course objective workload. Using the same frame of reference, course BMS 6632 assigned and recommended artifacts calculate to a 162% increase in overall course objective workload.

Instructional and Calendar Day Objective Workload

Framing the calculation for objective workload of the courses at the instructional and calendar day is represented in Figure 16. Course BMS 6635 includes 12 instructional and 16 calendar days while BMS 6632 includes 24 instructional and 33 calendar days.

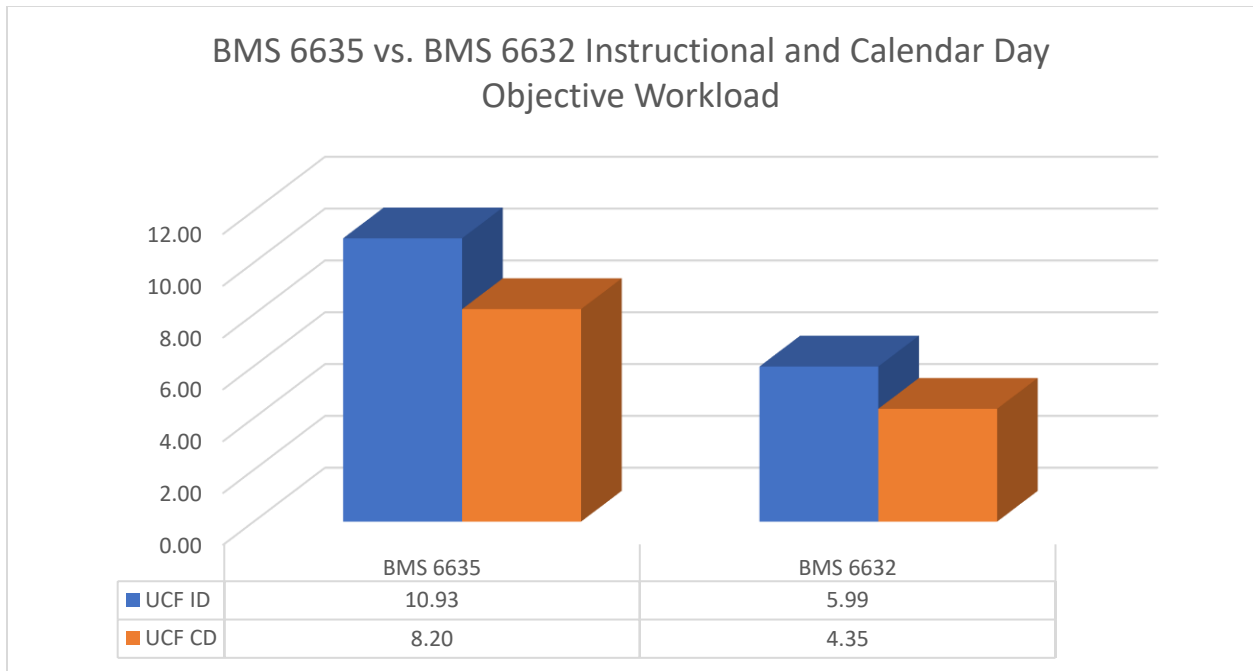


Figure 16: Instructional and Calendar Day Objective Workload for BMS 6635 and BMS 6632

According to the USCOM *Out of Class Workload Policy*, the instructional day objective workload for assigned artifacts calculated to 2.99 hours per day for course BMS 6635 and 2.27 hours per day for course BMS 6632. At the calendar day, the course BMS 6635 objective workload was 2.24 hours per day and course BMS 6632 was 1.65 hours per day respectively.

The addition of the recommended artifacts in the calculations for objective workload increase the instructional day hourly requirement for course BMS 6635 by 7.92 hours per day and the calendar day by 5.93 hours per day. Similarly, course BMS 6632 increases the instructional day objective workload by 3.75 hours per day and the calendar day objective workload by 2.7 hours per day. Irrespective of instructional or calendar day objective workload calculations; inclusion of the recommended artifacts in both course BMS 6635 and course BMS 6632 significantly increase the objective workload per day.

Artifact Modalities Comparison

The assigned and recommended course content as it pertains to modalities of instruction were compared between course BMS 6635 and course BMS 6632. Modalities of the assigned and recommended artifacts are represented in Figure 17.

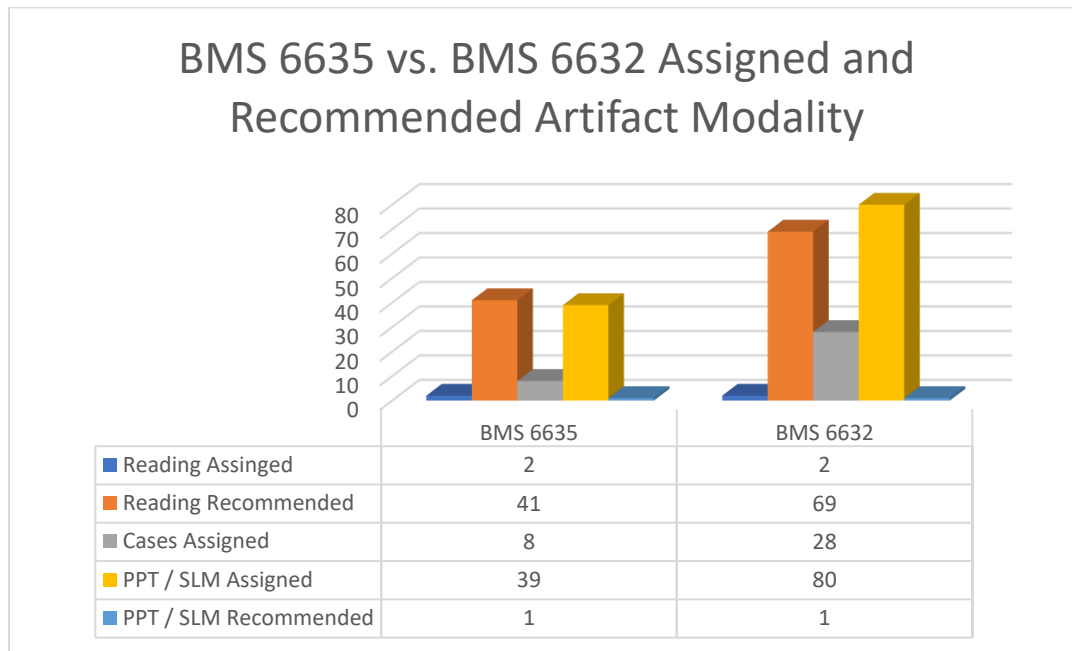


Figure 17: Assigned and Recommended Artifact Modality for BMS 6635 and BMS 6632

Comparing the assigned and recommended artifacts for each course reveals a high number of recommended reading assignments. These numbers are similar to the assigned PPT/SLMs. There is a comparable relationship between the assigned reading and recommended PPT/SLMs. Course BMS 6635 contains less active learning opportunities for the learner based on the eight assigned cases (16%). In contrast, 25% ($N = 28$) of course BMS 6632 enable active learning opportunities through case presentations.

Learning Objective Analysis.

As part of the objective workload analysis, a content analysis was performed on the learning objectives for course BMS 6635 and BMS 6632. The verb, content, and context of each learning objective were identified and classified according to Bloom's taxonomy (Bloom, Krathwohl, & Marisia, 1956). There were 167 learning objectives analyzed in course BMS 6635 and 286 learning objectives analyzed for course BMS 6632. The distribution of learning objective domains is represented as percentages in Table 21.

Table 21

Learning Objective Bloom's Domain Percentage

	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
BMS 6635	25.75%	47.90%	6.59%	16.77%	2.99%	0.00%
BMS 6632	15.38%	67.83%	0.70%	8.74%	4.20%	3.15%

The largest percentages of learning objectives for both course BMS 6635 and course BMS 6632 were classified in the domain of Comprehension and the lowest two domains were Synthesis and Application. During the M2 curriculum, the learners are simultaneously completing the cognitive requirements at the Course level and the psychomotor application through the Practice of Medicine (P-2) module. Sample learning objectives in each of the Bloom's domains are represented in Table 22.

Table 22*Course Learning Objective Examples*

Domain	BMS 6635
Knowledge	Define components of bone and cartilage matrix
Comprehension	Describe histologic criteria for common microscopic abnormalities.
Application	Interpret the image findings of SpA
Analysis	Correlate synovial histopathologic findings with imaging studies in early and late disease
Synthesis	Develop a systemic approach to a patient with suspected skin blister
Evaluation	
BMS 6632	
Knowledge	Define Metabolic Syndrome
Comprehension	Describe Graves' Disease
Application	Apply thyroid therapeutics to the management of myxedema coma.
Analysis	Compare treatments for BPH versus prostate carcinoma.
Synthesis	Outline the important components of the physical exam of a patient with ED
Evaluation	Evaluate various therapeutics for the treatment of insulin-induced hypoglycemia

Summary

Chapter 4 reported the results of RQ1 through RQ3, which included the descriptive analysis of each course, the content analysis of learner responses to the SPWS, and learning objectives for the module identified with the highest and lowest instructional day objective workload. Chapter 5 will discuss findings, limitations of the study, implications for practice, and propose future areas of study within medical education.

CHAPTER FIVE: DISCUSSION

Introduction

A study of the M2 curriculum was conducted at the Course level to determine the potential time and cognitive investment of medical education students in their second year of studies. Chapter 1 introduced the research questions, Chapter 2 reviewed the literature supporting the study, Chapter 3 outlined the methodology for conducting the research, and Chapter 4 presented the results of the analysis. Chapter 5 includes a discussion of the findings as well as discussion of study limitations, areas of future research, and implications for practice are presented.

Findings

RQ1

This study identified the academic resources available to the second-year medical student at one institution. All artifacts evaluated were available to the learner via the LMS and calculated for objective workload at the Course level. While there is difference in objective workload, the results of this study primarily focus on artifacts that are considered assigned to the student. As per the LCME guidance (2018), the institution is required to attest to the amount of time students spend in required activities. The existing USCOM *Out of Class Work Policy* identifies mandatory activities using the verbiage of *assigned* and non-mandatory activities using the verbiage *recommended*. Objective workload calculations attested by the LCME and published in

the USCOM are associated with assigned materials; recommended materials are not calculated for overall objective workload. Though the additional materials are recommended; without the context of USCOM *Out of Class Work Policy*, LCME guidance, and definitions of assigned versus recommended, it may be interpreted by the student as objective workload increasing their perceptions of bad subjective workload (Kyndt, et al., 2014; Marsh, 2001; Kember, 2004).

The current USCOM *Out of Class Work Policy* may underestimate the objective workload based on student perceived workload requirements. The USCOM *Out of Class Work Policy* calculation and the RICE CTE low workload estimations were similar. Calculation methodology for the Low assumed there were “No New Concepts” presented to the learner and the learner was required to “Survey” the materials. The USCOM *Out of Class Work Policy* calculation and the RICE CTE workload estimation at the High level identified significant differences in potential objective workload at both the Course and Year level. Calculations for the RICE CTE High assumed the artifact content contained “Many New Concepts” and the learner was required to “Engage” with the materials. Currently, the USCOM *Out of Class Work Policy* does not account for student variability in the reading rate, density of material, or intended use of the materials. This oversight may contribute to student’s perception of stress.

Medical education research has shown learners increase their use of alternate study practices as Step 1 approaches (Kumar, et al., 2015) using multiple modes of non-curricular study resources (Coda, 2019). Most of the instructional resources for the courses in the M2 year that are available to the learner as student-read MS PPTs and other reading assignments are passive forms of content delivery. Passivity in instruction can limit students’ understanding and efficacy attributing to burnout and depression, which have been tied to poorly designed

curriculum with limited applicability to the USMLE exam (Hill, et al., 2018). In contrast, active use of multimedia principles in medical education has shown to increase retention, test scores, and promote critical thinking when implemented (Issa, et al., 2011; Youngblood & Beitz, 2001).

Research on the efficacy of e-learning strategies and their translation to the clinical environment is in its' infancy at this point but shows promise based on multiple research designs and domains of healthcare education (Sinclair, et al., 2015). Recommendations noted are identification of instructional strategies or teaching strategies that have been shown to increase learner retention. Some strategies used to enhance learners' retention and transference of skills to the work environment have been small-group discussions and role modeling, team based learning, and human patient simulation (Hallin, et al., 2016). Additionally, the implementation of active learning principles has been correlated to increases in student efficacy (Gaffney et al., 2013), student perception of course satisfaction (Winstone & Millward, 2012), and student engagement (Gossman et al., 2015). Active learning has shown to increase retention and intellectual effort when implemented within a course (Fiorella & Mayer 2013, 2014; Gossman et al., 2015).

Potentially ambiguous instructional requirements, inaccurate assumption for calculations of objective workload, and passivity in instructional delivery are comparatively different; however, the combination of these factors may have a synergistic effect on the learner. This effect may increase the students' desire to prioritize their choice of alternate instructional content and personal workload based on self-directed motivators (Lujan & DiCarlo, 2017). These factors can also affect the learner's overall perceptions of workload and satisfaction of course content.

Analysis of the SPWS indicate course BMS 6632 is reported to have the highest student perception of workload (2.76) as well as the highest student satisfaction (4.15). Previous research has shown that a contributor to student stress is the volume of information required for course completion (Hill, et al., 2018). Though this study does not report overall stress, the indication of high perceptions of workload coupled with the highest satisfaction through the M2 may confound previous research results. The results indicate M2 curriculum is within the USCOM *Out of Class Work Policy* limits for assigned artifacts (United States College of Medicine, 2016),

RQ2

The framework method (Gale, et al., 2013) was used for the content analysis of 99 statements concerning the learner's perception of instruction. Statement were association with domains within the ARCS framework (Keller, 2009) and indicated positive motivation in 84 statements (84.85%), both positive and negative motivation in 14 statements (14.14%), and one statement (0.01%) of negative motivation. Assessing the results of the ARCS framework at the Course level indicated confidence as the leading motivator in all courses except BMS 6632.

Confidence is increased as a motivational factor when the learners are informed of the learning and performance requirements, which allow them to succeed through their abilities at challenging and meaning experiences (Keller, 1987). In this study, learners expressed confidence in the curriculum and in the opportunities afforded them through all M2 courses. Confidence can contribute to self-efficacy and can be predictive of engagement and increased through mastery level experiences. The greater the level of self-efficacy one possesses, the higher the levels of self-regulation, self-organization, self-reflection, and self-correction (Bandura, 2008). Each of these self-regulating activities associated may be improve academic performance (Wu, et al.

2020). This study supports prior research as noted by the learners consistently expressing the highest level of motivation when they were allotted adequate time for self-directed learning activities.

Inversely, attention was the lowest motivational factor in all course presented in the M2 year. Keller (2009) subdivides the domain of attention into perceptual arousal, inquiry arousal, and variability. Further defining the domains indicate the relation of curiosity to perceptual arousal, problem solving associated with inquiry arousal, and variability of instructional approaches associated with variability. Although the content analysis reported multiple courses with positive and positive/negative comments associated with attention, the overarching theme associated with the lack of motivation focused on instructional variability. Issues associated with student motivation may be addressed through curriculum reform.

Curriculum reform has been associated with the Pillars as theorized by Pock, Pangaro, & Gilliland (2016). Association of the ARCS methodology and affecting student motivation is addressed in Pillar I and referred to by an individualization of the learning process. Multiple institutions have enacted curriculum reform based on Pillar I, but there have been limited reform initiatives based on individualizing pedagogical methods of instruction (Dienstag, 2011; Wackett, et al., 2016; Fischel, et al., 2018). Furthermore, there has been no published research reporting the use of ARCS strategies as an instructional design methodology for course development in medical schools.

Research conducted in allied health fields has shown the use of ARCS strategies in instructional development may lead to changes in student motivation when delivered via online or face-to-face modalities (Keller, 1987, 2017). Studies have also shown a relationship between

motivation (both intrinsic and extrinsic) and self-efficacy (Hayat, et al., 2020). Medical students require high levels of self-efficacy and confidence due to the need for clinical competency and course work completion, therefore, the ARCS model for motivation may be an asset for curriculum reform efforts at individual institutions.

RQ3

The courses of the M2 module with the highest and lowest instructional day objective workload were identified and explored for difference. All the results for RQ3 are based on the courses of BMS 6635 and BMS 6632.

Course BMS 6635 requires the highest objective workload per instructional and calendar day as calculated by the USCOM *Out of Class Work Policy*. The SPWS identified this course as the middle data point representing a *Significant but Manageable* workload concerning students' perceptions of workload as well as the middle data point concerning student satisfaction. When associated with the ARCS framework, course BMS 6635 was coded with the least motivation from the students throughout the M2 year in all ARCS framework domains. Conversely, course BMS 6632 requires the lowest objective workload per instructional day by the USCOM *Out of Class Work Policy*, the highest student satisfaction score and the highest *Significant but Manageable* mean scores on the SPWS. When associated with the ARCS framework, course BMS 6632 was coded with the highest confidence domain of motivation throughout the M2 year.

Research has shown that a contributor to student stress is the volume of information required for course completion (Hill, et al., 2018). Though the instructional day and calendar day variables as calculated are quantitative and the content analysis variable is qualitative, results comparing the two data sets imply the courses with the higher workload negatively affected the

learner's motivation but does not specifically affect their satisfaction with the course of instruction. This study does not assume the assertion of increased student stress with increased objective workload as stress was not specifically measured.

A learning objective analysis was performed for courses BMS 6635 and BMS 6632 using Bloom's taxonomy (Bloom, et al., 1956). The content analysis identified the Bloom's taxonomy domain of comprehension as the primary domain (Bloom, et al., 1956) for the learning objectives in the courses. Perceptions of workload have been linked to reading rates and associated with cognitive levels within Bloom's taxonomy (Bloom, et al., 1956). Research has shown the reading rates vary between 400–100 words per minute when reading for comprehension (Rayner, et al., 2016; Carver, 1982; Siegenthaler, et al., 2011) and drastically reduce when there is a future need for application of the knowledge (Parker, 1962).

The foundations of medical education require specialized knowledge in the workings of organic systems. The knowledge required has been categorized as lower-order and higher-order cognitive skills (LOCS/HOCS) (Zoller, 1993). The BBT identifies the domains of knowledge and comprehension as LOCS, the domain of application as a transitional stage between LOCS and HOCS, and analysis, synthesis, and evaluation as HOCS (Crowe, et al., 2008). Evaluation of the learning objectives in a medical curriculum through the lens of the BBT and classification of LOCS/HOCS has been accomplished at other institutions resulting in previously identifying only 25% of objectives classified as HOCS (Crowe, et al., 2008). The results of this study indicate similar result for course BMS 6635 (20% HOCS) but were slightly lower for course BMS 6632 (16% HOCS).

Increased stress and an overall decrease in student well-being have been attributed to academic workload (Dyrbye, et al., 2010), the *hidden curriculum*, and preparation for high stakes assessment (Hill, et al., 2018). Research has shown that some learners begin preparation for high stakes assessments early (Burk-Rafel, et al., 2017) using materials that may not align with institutional objectives (Leff & Harper, 2006). The early study and resilience of the learner indicates their motivation for learning, which has been a key indicator in achievement even when the content is challenging (Fairchild, et al., 2005). A medical school curriculum must provide the learner with the materials that enhance their motivation while simultaneously provide confidence in their ability to succeed when taking high-stakes examinations and not exceed the cognitive load limits of the learner.

Bloom's taxonomy provides a window into cognitive load. Cognitive Load Theory (Sweller & Chandler, 1994) proposes working memory has a limited capacity and duration which should be considered in the design of instruction. The design of the materials and the complexity of the content to be learned both play a part in the learner's ability to transfer information from short to long term memory (Sweller, et al., 1998). Medical education should be constructed so the learner can scaffold the information in a meaningful way for recall at a later date (Ausubel, 1968).

Limitations of the Study

Social Desirability Responding (SDR) may be a limitation of this study. SDR is the tendency for people to present a favorable image on questionnaires (van de Mortel, 2008). A meta-analysis of health-related studies indicated that SDR influenced their result at a rate of

43%. There is a possibility the learners in the M2 curriculum fell victim to the SDR based on the time frame of required submission at the end of the course of instruction and the desire to maintain a favorable mentoring relationship with the faculty.

The method of analyzing the data is a limitation of this study. Content analysis allows researchers to draw inferences from text thereby capturing the words and their context (Miller & Alvarado, 2005). Coders were provided the methodology and foundational elements of the research through the instructions (Appendix B), but course and learner demographic information, sequence of instruction, or scope of instructional materials were not provided. Coders were then provided the list of individual sentences to associate with the ARCS framework. The coders drew their own conclusion concerning learners' intent. The subjectivity of coders may have caused a learner statement to be attributed incorrectly to the ARCS framework. To mitigate some subjectivity, multiple Coders read each statement independently.

An additional limitation to the study was the process followed to obtain student surveys. *Student Perception of Workload Surveys* are distributed at the end of each course by the instructor and required mandatory completion for all class participants. The data gathered may be skewed based on the mandatory requirement providing unrealistic metrics for evaluation. However, there was consistency in the students' comments throughout the M2 curriculum.

The RICE CTE workload estimator and the methodology used is a limitation. There have been no published studies using the workload estimator as an instrument for evaluation of medical school workload. Moreover, the estimator includes writing assignments, and formative and summative input fields, which were not used in this study. Finally, the methodology employed used the density of *paperback* when calculating PPT/SLM objective workload. On

evaluation of the assigned or recommend PPT/SLMs, there was extensive amounts of written materials, often new and unfamiliar to the learner. The result of objective workload associated with PPT/SLM may not be reflective of actual student workload.

Finally, the instruments and policy used to measure the student workload are a limitation of this study. The SPWS and the USCOM policy do not have measures of validity. Validity measures the degree to which questions in a survey describe the intended measure (Sullivan, 2011). The SPWS measures multiple aspects of the student's perceptions, not specifically the workload requirement. Additionally, since data was gathered and calculated for this study, the SPWS was amended to reflect student reporting of hours spent during the module. The USCOM policy was created based on the requirement of the LCME and was accepted as adequate for accreditation. This policy has never been validated before this study. Additional research on validation of workload should be performed at USCOM.

Innovation to the Field

The design of this study introduces a new application of the ARCS framework. ARCS has been introduced previously for other motivational aspects of instruction (Nicolai, et al., 2017, Leeuw, et al., 2019), but has not been applied to students' perceptions of workload and curriculum reform in medical education. Applying the framework in this manner will assist instructional designer in reverse design of course goals or to assist medical educators in refining curriculum to match or enhance student motivation and perhaps the reduction of stress related to objective workload.

The differentiation of objective and subjective workload have not previously been associated to medical education workload calculations. The two terms are not found in the literature associated with medical school but are regularly used in research in engineering education. While reading rates of medical students have been used as an indicator of workload (Rayner, et al., Siegenthaler, et al., 2011 2016; Carver, 1982; Parker, 1962), there have been no published research using the classifications of objective and subjective workload. Implications for Practice

Implications for Practice

Preparation for disasters and curriculum artifacts:

Natural disasters are floods, earthquakes, or hurricanes which cause great damage or loss of life. In the academic environment, these disasters can also interrupt the education process either by organizational, state, or federal mandate (Florida Department of Education, 2020). The shutdown of academic institutions has drastically affected quantity and quality of medical education (Nicola, et al., 2020). Responses from participants in this study expressed dissatisfaction with course BMS 6633 specifically due to the compressed course time due to hurricane evacuation requirements. While this study demographic is the second-year medical students, identification of options and plans of action at institutions should focus on the continued education of students when disasters hinder traditional instructional methods.

Natural disasters have impacted clerkships frequently in the past. Published articles (n = 1288) specific to medical education have identified required actions at the institutional level when faced with a disaster. The actions are classified in two major axes identified as

“challenges” and “Innovative solutions” (Dedeilia, et al. 2020). The challenges axis identifies differences between disasters and responses with concern to medical students’ involvement in disaster response. Previous disasters (fires, hurricane response, floods, terrorism) have served as a fast-paced clinical learning experience for medical students (Rose, 2020). In contrast, the COVID-19 pandemic has cancelled clinical clerkships due to social distancing and the declared state of emergency. Additionally, the COVID pandemic has increased medical students’ anxiety, stress associated with board certifications, and loneliness due to social distancing requirements and perceived family obligations (Gallagher & Schleyer, 2020).

To combat the stressors and have additional assets for patient care, some institutions have considered early graduation and employment of final-year medical students. As clinical rotations were postponed or canceled, discussion around the world has focused on the role of medical students and the COVID response (Harvey, A. 2020; Mahase, E. 2020). The introduction to the clinical environment may have higher benefits than the risks if implemented pragmatically. Recommendations include introduction of the final-year medical students as a clinically competent part of the healthcare team allowing for clerkships to continue with Non-COVID outpatients (Miller, et al., 2020). Lessons learned from previous disasters and the current COVID pandemic may support early entry into the clinical environment which has been identified as a Pillar of curriculum reform (Pock, et al., 2016). The early clinical entry may increase the application of the hidden curriculum by instilling professionalism, altruism, and solidarity (Dedeilia, et al., 2020). Therefore, institutions could partner with the clinical clerkship directors at supporting facilities to design a policy for the integration of medical students’ skills in support disaster relief efforts as well as build student efficacy in the clinical care environment.

The innovative solutions axis identified options for institutions to consider when creating curriculum. These options include increased use of tele-conference, webinars, increased asynchronous online learning, as well as active learning principles. The current study results indicated higher learner motivation as measured by the Keller ARCS model when the students were provided self-directed learning activities as well as increased active learning approaches. This study is supported by previous literature indicating active learning techniques are preferred by medical students (Lieberly, et al., 2016). Though the concepts of self-directed learning and student motivation were in the context of medical education, principles of online learning and student engagement can be applied to all curriculum design activities.

Medical curricular reform in the past decade has primarily revolved around a flipped classroom and integration active learning principles (Rose, 2020). When implemented incorrectly or inappropriately, a poorly designed course leads to low motivation for the learner and ultimately poor learning outcomes (Woodworth, et al., 2015). To combat poorly designed courses, instructional designers should strive to enhance the online learning environment by the inclusion of interactive technology for active and engaged learning (Reinholz, M., & French, L.E., 2020). New skills are required to transition from the face-to-face delivery method to online delivery which requires in depth analysis, increased knowledge of learning and teaching modalities, as well as new lesson planning and development skills (Johnston, et al., 2005; Mayer, 2014). Though inclusion of interactive content has shown to increase learner engagement, some instructional material is not suited for transfer to an interactive authoring tool. In this case, passive methods of instructional content delivery can be enhanced using multimedia principles.

In a previous study, one group of students reported their perceptions of content delivery after evaluating eight video styles containing standardized content in the domain of life sciences. The report included the student's perception on efficacy of video style as well as a simple explanation of factors which influenced their video efficacy evaluation. In addition, a second group of students completed summative assessments based on the learning content delivered via the highest ranked video styles. The learning outcomes differences were not statistically significant, but the video presentation style did indicate a difference in learner satisfaction (Choe, et al., 2019). In consideration of these finding, instructional designers and medical educators should integrate approaches to video delivery which enhance the learner satisfaction and attention such as the demonstration or the looking glass method.

Team based learning and problem-based learning are learner-centered approaches used to place more autonomy on the student, spend less in-class time delivering content, and spark critical thinking (Gullo, et al., 2015). Both approaches have been used in varying domains of instructional design. Team based learning involves the preparatory phase, readiness tests (individual and team), and an application phase. Methods of creating effective team-based learning focus on facilitation by faculty and a shift in the student / teacher relationship. Problem based learning is a methodology which assumes to trigger a students' interest by making them aware of gaps in their knowledge, acting as a driving force for learning (Schmidt, et al., 2011). The quality of a problem is the key to successful PBL and sparking students, interest. For a problem to be of interest to a learner the construct of the problem should be familiar to the student, promote collaborative learning, result in intended learning outcomes, and stimulate critical reasoning (Sokalingam, et al., 2012).

USCOM should identify courses that may benefit from increased active learning methods and apply the TBL/PBL methodology where appropriate. Additionally, transitioning from the face-to-face delivery method to a more learner-centered approach may mitigate some educational missed opportunities due to disaster response. Finally, USCOM should communicate their disaster plan to students' during matriculation to potentially assist in stress mitigation as well as offer resiliency courses in the event a natural disaster occurs.

Learning Objectives:

The LCME in standard 6.1 requires that all learning objectives be communicated to faculty and students using outcome-based terms (LCME, 2018). A learning objective is a clearly written, specific statement of observable and measurable learner behavior (Chatterjee & Corral, 2017). In the present study, the two courses evaluated revealed 13% and 16% of the language used within the learning objectives to be rejected from the analysis due to ambiguity of instructional intent. Learning objectives are the starting point of self-guided study (Noordzij & Wijina, 2020) and should include 5 elements: 1) who, 2) will do, 3) how much or how well, 4) of what, 5) and when (Thomas, et al., 2016). Instructional designers, curriculum developers, and faculty training associates should provide initial training or cognitive aids expressing the requirement of the LCME standards and appropriate structure of learning objectives. Additionally, recurring training and periodic curriculum evaluation should be enacted to assure the efficacy of the learning objectives and intended learning outcomes.

Assigned vs. Recommended Materials:

Through analysis of the assigned and recommended artifacts, there appears to be a relationship between the assigned PPTs and recommended reading which may lead to learners' confusion as to the efficacy of institutional curriculum. Research has shown that students choose alternate and potentially distracting academic resources when not provided specific instruction pertaining to resource relevancy (Hill, et al., 2018). This study identified through student response some courses were assumed to be high yield, but there is no empirical evidence from summative assessments to support the students' perceptions. It is suggested the instructional faculty select and inform students of resources which will yield the desired academic outcomes. If recommended reading cannot be completely removed from the curriculum, faculty may alleviate students' misperceptions of resource efficacy by providing a ranked list of alternate resources.

Medical School Workload Estimator

Results of this study indicated courses with the higher calculated objective workload were associated with students' reporting lower perceptions of satisfaction. A decreased perception of satisfaction can impact learner motivation. Research has shown medical student experience decreased motivation (Woodworth, et al., 2015) and an increase in stress when they perceive a lack of curriculum utility (Hill, et al., 2018). In addition, this study analyzed the didactic or cognitive components of the M-2 curriculum without accounting for the time required for psychomotor association of skills during the P-2 module.

A medical education requires not only the institutionally prescribed materials but also continued reading of academic journals specific to patient conditions (Leff & Harper, 2006),

self-directed studying for high stakes examinations both for institutional standing and preparatory for medical boards, as well as practicing patient care skill critical for the clinical environment. Therefore, reading rates as the primary factor for calculation of workload may underestimate the actual time requirement for mastery of all concepts associated with a medical education. The inadequate assessment of all workloads may be an additional contributing factor to medical students' declining overall wellbeing.

The USCOM policy was accepted by the LCME in accordance with accreditation standards, but there have been no previous published studies on the assessment or validation of the policy. Without analysis of the efficacy of the policy, current and future medical students may continue to experience increased stress, depression, and thoughts of drop out due to unrealistic institutional workload requirements. USCOM should devise calculations based on modification of the SPWS to accurately describe both the objective and subjective student workload then adjust their institutional policy to reflect the depth and breadth of a medical education.

Survey Design:

The SPWS requires mandatory student completion at the end of each module but may not be a valid instrument for gathering the intended data to guide institutional change. Poorly designed survey instruments may be difficult for the learner to answer which can yield low quality data for researchers. A previous study indicated 94.6% (n=37) of survey's contained at least one violation of best practice in survey design (Artino, et al.,2018). In this study, the SPWS was identified as a potential limitation. Though the SPWS is not specifically intended for study publication, the data gathered may continue to be used in that manner. Therefore, it is important

to identify academic journal hesitancy to publish survey research due to poor design quality of the survey instrument (Story, et al., 2011).

Questions on a survey should be clearly aligned with the research objective, present the smallest possible number of high-quality, essential, items of interest for the target population (Story & Tait, 2019). The instrument should focus on the *need-to-know* information and avoid the *nice to know* information for data clarity (Jones, et al., 2006). The LCME requires end of course surveys, but the course survey should be clearly designed to ask the questions which will present high yield information for student time requirements, resources used for the curriculum, stress indicators, and student resiliency strategies. The accurate data will provide guidance for meaningful institutional policy alignment with students' perceptions and needs.

Summary

A medical education study was conducted of a second-year curriculum at a large southeast university to investigate time spent learning the curriculum and determine student's perception of time and satisfaction related to the course. Assigned and recommended course artifacts were assigned a time code using the USCOM *Out of Class Work Policy* and the RICE CTE workload estimator. Calculations of the artifacts using each policy at the Course and Year level were compared and explored. Student's perceptions of academic workload were associated with the ARCS framework as theorized by Keller (2009) and the student satisfaction results were compared to perceptions. Finally, a content analysis was performed on the learning objectives of two courses in the M2 curriculum.

The findings indicated the USCOM *Out of Class Work Policy* and the Low calculations for the RICE CTE are similar but may be underestimating student workload. This underestimation may be due to a higher percentage of learning objectives identified in the Comprehension domain of Bloom's Taxonomy (Anderson, et al., 2001). The calculations for objective workload may need to be evaluated for adjustment due to research on reading rates indicating when comprehension of the material is required as reading rates can slow to as little as 50 words per minute (Carver, 1982; Parker, 1962). Content analysis of the student's perception of workload indicate an 85% positive association with the ARCS framework for student motivation and satisfaction with the curriculum.

Implications for practice include disaster preparedness, curriculum analysis considerations, student workload estimations, and survey design. The assessment of institutional disaster preparedness should include the possible employment of medical students for use in the clinical environment to facilitate disaster relief as well as methods for content delivery in the event of a disaster. Clearly written and out-come based learning objectives are a required component for accreditation. Learning objectives and curriculum components should be clearly articulated as well as designed with learner-centered and active engagement strategies to increase the motivation of students while simultaneously allowing for remote delivery. Finally, identification of actual student workload through meaningful survey instrument design will enhance useful metrics to assist institutional goal alignment and achievement.

In summary, "If we add anything further to the medical curriculum, let it be spare time." (Okell, 1938).

**APPENDIX A:
STUDENTS' PERCEPTION OF WORKLOAD SURVEY**

Module Organization and Content:						
		SA	A	N	D	SD
Q1	Module content was clearly related to the learning objectives					
Q2	Content was well organized and presented in a logical sequence					
Q3	In general, the teaching methods used in this module (e.g., lectures, team-based learning, etc.) facilitated my learning					
Q4	Curriculum materials (e.g., slides, cases, reading assignments, SLMs) were effective in helping me achieve the learning objectives					
Q5	There was sufficient time for self-directed/independent study					
Assessment:						
		SA	A	N	D	SD
Q6	Formative assessments (online quizzes) helped me prepare for summative assessments					
Q7	Summative assessments accurately reflected learning objectives					
Q8	There was adequate opportunity for faculty feedback on my understanding of course content throughout the module					
Affiliate and Volunteer Faculty:						
		SA	A	N	D	SD
Q9	In general, presentations by guest lecturers (e.g., affiliate/volunteer faculty) were presented at an appropriate level					
Overall:						
		MTL	L	SBM	TH	MTH
Q10	The workload in this module was					
		SA	A	N	D	SD
Q11	In general, I am satisfied with this module					
Q12	Strengths of this module:					
Q13	Suggestions for improvement:					

**APPENDIX B:
CODER INSTRUCTIONS**

Theoretical Foundation

Theory in instructional design provides a means to understand how students learn and what their motivation may be for learning. USCOM students complete a *Students Perception of Workload Survey* at the completion of each module of instruction. Question 12 allows the students to express their perceptions of the “strengths of the module.” Based on the wording of the survey, the learners are asked to indicate not only their perception of time, but also their personal values as they relate to the prescribed curriculum. These perceptions of time and value relate to the students’ motivation as provided by the Keller’s ARCS model framework (see Table B-1). While the ARCS model has been used extensively in the healthcare setting, the foundations of ARCS have been used in studies to improve hygiene (Al-Tawfiq & Pittet, 2013) and as an assessment of motivational approaches for instructing expectant mothers (Stockdale, Sinclair, & Kernohan, 2014).

The ARCS model, developed by Keller (2009), includes the four domains (Attention, Relevance, Confidence, and Satisfaction) as well as subcategories used to further enhance and describe learner motivation (Keller, 2009). The original design of ARCS was for creating learning strategies with the assertion that the four domains of human motivation can be influenced by methods of presentation; this study will focus on the domains of Relevance, Confidence, and Satisfaction as associated with the *USCOM Students’ Perception of Workload Survey*.

Table B-1*ARCS Model Components (Keller, 1987)*

Attention	Relevance	Confidence	Satisfaction
<i>Perceptual Arousal</i>	<i>Goal Orientation</i>	<i>Learning Requirements</i>	<i>Intrinsic Reinforcement</i>
Provide novelty and surprise	Present objectives and useful purpose of instruction and specific methods for successful achievement	Inform students about learning and performance requirements and assessment criteria	Encourage and support intrinsic enjoyment of the learning experience
<i>Inquiry Arousal</i>	<i>Motive Matching</i>	<i>Successful Opportunities</i>	<i>Extrinsic Rewards</i>
Stimulate curiosity by posing questions or problems to solve	Match objectives to student needs and motives	Provide challenging and meaningful opportunities for successful learning	Provide positive reinforcement and motivational feedback
<i>Variability</i>	<i>Familiarity</i>	<i>Personal Responsibility</i>	<i>Equity</i>
Incorporate a range of methods and media to meet students' varying needs	Present content in ways that are understandable and that relate to the learners' experiences and values	Link learning success to students' personal effort and ability	Maintain consistent standards and consequences for success

The category of Attention centers on the students' curiosity and interests, incorporating the subcategories of perceptual arousal, inquiry arousal, and variability. Perceptual arousal is related to curiosity and occurs when there is any sudden or unexpected change in environment. Inquiry arousal enhances the learner's curiosity by providing a problem situation for the learner to solve. Variability refers to variation in instructional approach.

Relevance of course material is based on the students' perceived value of the curriculum content and includes the subcategories of goal orientation, motive matching, and familiarity

(Keller, 2009). Motivation and motive matching are increased if the course content is perceived to help them achieve their specific goals. Confidence can be affected by the learner's expectation for success and is enhanced through the subcategories of learning requirements, successful opportunities, and personal responsibility (Keller, 2009).

The final concept in the ARCS framework is satisfaction which includes the subcategories of intrinsic reinforcement, extrinsic rewards, and equity. To help maintain a desire to learn, the student must feel some satisfaction with the process and experience. Intrinsic reinforcement may include feelings of accomplishment, enhanced self-esteem, or mastery of a skill; extrinsic rewards can include grades, certifications, or advancement opportunities, and equity enhances a sense of fairness through course goals (Keller, 2009).

The ARCS model may be an appropriate lens for evaluating student motivations to learn in the USCOM based on specific domains of the ARCS. The ARCS model and the associated subcategories can be related to the students' motivation to learn, and to the amount of time required to complete medical school academic activities.

Methodology

Surveys were de-identified by the student academic services office and presented for analysis. Data from the surveys was copied and pasted into a word document and spell checked for accuracy of inclusion and exclusion criteria. Student individual responses to Question 12 were separated into individual sentences then copied back to an MS Excel spreadsheet. The keywords in Table B-2 were searched in the Excel spreadsheet and selected as entries for inclusion in the content analysis.

Table B-2

Keywords

Keywords						
Again	Days	Ever	Lifetime	Opportunity	Step	Time
Break	<i>Duration</i>	Just	Long	Point	Term	While
Date	Effort	Late	<i>Once</i>	Schedule	Then	Year

<https://www.powerthesaurus.org/time/synonyms>

**APPENDIX C:
IRB APPROVAL**



UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board

FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway Orlando, FL 32826-3246

APPROVAL

February 3, 2021

Dear Jason Pollock:

On 2/3/2021, the IRB reviewed the following submission:

Type of Review:	Continuing Review
Title:	Validation of course workload calculations to monitor medical student time-on-task.
Investigator:	Jason Pollock
IRB ID:	CR00000917
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Pollock_Student_irb_HRP-502_ADULT_CONSENT_FORM_2019 group.pdf, Category: Consent Form; • irb_HRP-509_Rev B_SUMMARY_EXPLANATION_FOR_EXEMPT_RESEARCH_F aculty-Mar2020 copy.pdf, Category: Consent Form;

The IRB approved the protocol from 2/3/2021 to 2/2/2022.

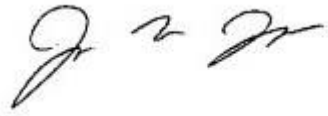
In conducting this protocol, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system. Guidance on submitting Modifications and a Continuing Review or Administrative

Check-in are detailed in the manual. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu.

Please include your project title and IRB number in all correspondence with this office.

Sincerely,



Racine Jacques, Ph.D. Designated

Reviewer

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