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Impact of USMLE Step 1 grading changes on medical student goal orientations and learning strategies

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by

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Abstract

Impact of USMLE Step 1 grading changes on medical student goal orientations and learning strategies

by

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The National Board of Medical Examiners recently announced the change to a pass/fail grading structure for Step 1 of the United States Medical Licensing Exam with the intent to improve medical student psychological well-being. Medical educators have the chance to study the impact this change will have on medical student achievement goals and use of self-regulated learning strategies. This report proposes a study to examine this relationship. With the field of medicine constantly growing and changing, physicians must be able to self-regulate their learning to keep current in their fields and it is imperative that medical schools foster the skills, behavior, and attitudes of self-regulated learning in their students.

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Introduction

In the past few decades, medical education has undergone a shift in the way medical students are graded during their preclinical education, away from tiered grading systems and into pass/fail grading systems with no class rankings. The goal is to improve psychological well-being of medical students (McDuff et al., 2014) as well as foster the development self-directed learning skills, behaviors, and attitudes to prepare them for continuous, life-long learning as physicians (White and Fantone 2010; Spring et al. 2011). Not only has preclinical grade reporting changed, but in February 2020, the National Board of Medical Examiners (NBME) announced that they would change the score reporting of Step 1 of the United States Medical Licensing Exam (USMLE), colloquially known as "Step 1," from a three-digit performance score to a pass/fail score (*Change to pass/fail score reporting for Step 1*, 2019). This transition gives medical educators the opportunity to examine the impact this change will have on medical student study strategies. Of particular interest to this author is the relationship between Step 1 exam grading structures, student motivation, and the use of self-regulated learning strategies.

Medicine as a field is constantly growing and changing, and physicians of today are expected to keep up to date with current developments within their specialties. This requires physicians to have the tools and skills to learn independently, and it is imperative for medical education to promote the development of physicians who can self-regulate their learning (Cutrer et al., 2017). Motivational theories within the field of educational psychology can provide insight into what factors contribute to medical student study practices and can be leveraged to help medical students develop into self-regulated, lifelong learners. One such motivational theory, Achievement Goal Theory, states that students' motivations and behaviors

related to achievement can be broken down into two purposes, or orientations, for student learning: mastery and performance (Ames and Archer 1988). Students with mastery goals are more likely to use adaptive learning strategies characteristic of self-regulated learners and students with performance goals are more likely to use maladaptive learning strategies (Senko 2016, Conley 2012). Furthermore, achievement goal theory states that a student's achievement goal orientations can be influenced by the policies and practices of the environment in which they learn, which are known as goal structures (Wolters 2004).

In this paper I will provide a brief review of changes to undergraduate medical education and licensing exam grading systems, review literature on the relationships between achievement goal orientations, goal structures and self-regulated learning strategies, and propose a study to examine the relationships between USMLE Step 1 grade reporting, student perceptions of goal structures, and student use of self-regulated learning strategies. By gaining a better understanding of these relationships, medical educators will be better equipped to provide education environments and structures that promote the development of adaptive learning habits in students, which students can then carry with them throughout their careers as physicians.

Literature Review

The Shift to Pass/Fail in Medical Education

Medical education in the United States is a long and arduous process that can be split into three distinct phases: Undergraduate Medical Education, Graduate Medical Education, and Continuing Medical Education. Undergraduate Medical Education is typically a 4-year program where medical students learn the basic science behind medicine and gain exposure to the various fields and environments they may practice in as doctors. Undergraduate Medical Education typically consists of 1-2 years of intense classroom coursework in the basic sciences (preclinical years) after which students take their first board exam, called the USMLE Step 1, the first of a three-part licensing exam in the United States. While students must only get a passing score on the USMLE board exams to obtain their medical license, they are also given a three-digit score, typically ranging 140 to 260, to allow schools and residency programs to directly compare the exam performances of all students who have taken the exam that year. This score has a significant impact on the students' options for residencies and specialty choice in the future, as it is a top factor that residency program directors consider when reviewing applications for residency interviews (McGaghie et al., 2011; National resident matching program, 2018).

Following the preclinical years, medical students get two years of clinical clerkships where they get experience learning in hospitals and outpatient offices. Once graduated as doctors, they enter Graduate Medical Education, also known as residency and fellowship training, where they receive 3-7 years of specialty and subspecialty training. Once residency and fellowship training are over, they can practice medicine independently in their fields, but

must take a certain number of classes per year, called Continuing Medical Education, to maintain their licensure.

On top of Continuing Medical Education, physicians informally continue their education with independent study. The field of medicine is constantly changing as new techniques are developed and new discoveries are made. Hundreds of thousands of medical papers are published each year (*Citations Added to MEDLINE® by Fiscal Year*, 2020), and physicians are expected to stay current on the latest research and guidelines in their fields. A physician must study and learn throughout the entirety of their career, from medical school to residency to full practice, far beyond their years of formal education. This expectation of life-long learning requires physicians to develop self-directed learning skills such as monitoring their current levels of knowledge, setting learning goals, utilizing effective learning strategies, managing time efficiently, evaluating the efficacy of their strategies and adapting accordingly. These processes are components of self-regulated learning, and they are the hallmarks of an effective life-long learner (Zimmerman, 2002). However, self-regulated learning is not formally taught in medical schools (Artino et al., 2012; White & Fantone, 2010) and many medical graduates do not feel prepared to direct their own learning during their careers (Weed, 1997).

The last few decades have seen a shift in grading structures across medical schools in the United States from tiered scoring to pass/fail grading in preclinical years (McDuff et al., 2014). With this shift have come numerous studies on the effect this change has on student psychological well-being and academic achievement (Ange et al., 2018; Bloodgood et al., 2009; McDuff et al., 2014; Spring et al., 2011). These studies have shown positive effects of pass/fail grading on student psychological well-being and a similar overall academic performance when

compared to tiered grading. Aside from the benefits to the psychological well-being of medical students, the shift from tiered grading to pass/fail grading in preclinical undergraduate medical education aims to help future physicians develop into self-regulated learners by promoting mastery learning (Spring et al., 2011; White & Fantone, 2010).

The transition to pass/fail score reporting on the USMLE Step 1 is being made, in part, for similar reasons as the shift to pass/fail medical school curricula: improving psychological well-being. The primary purpose of Step 1 is for a passing score to demonstrate a student's competency to medical licensing bodies, but a secondary use has emerged where programs use examinee scores to screen and select applicants for residency positions (*Change to pass/fail score reporting for Step 1*, 2019). This unintended and unvalidated (McGaghie et al., 2011) use of Step 1 scores has led to a "Step 1 climate" in medical schools where students disengage from institutional curricula and pursue a concurrent "parallel curriculum" directed at maximizing Step 1 score, often with the aid of multiple pricy commercial study products (Chen et al., 2019). Part of NBME's goal in changing Step 1 to pass/fail score reporting is to combat this Step 1 climate and, in doing so, improve psychological well-being in medical students in the same way as transitioning to pass/fail grading in undergraduate medical education (*Change to pass/fail score reporting for Step 1*, 2019). This transition also gives those in medical education the opportunity to study how transitioning to pass/fail Step 1 score reporting will impact student motivation and use of self-regulated learning.

Self-regulated learning consists of various cognitive and metacognitive skills, such as the ability to make goals, manage time, monitor one's progress, and self-evaluate the effectiveness of one's learning (Zimmerman 2002). Beyond the cognitive and metacognitive aspects of self-

regulated learning, however, is another dimension: motivation. The relationships between motivational beliefs and self-regulated learning strategies are well studied, with some motivational beliefs helping to "promote, sustain, or facilitate self-regulated learning" (Pintrich, 1999). While there are many motivational theories that model student motivation and learning (Pintrich, 1999), this paper will focus on achievement goal theory.

Achievement Goal Theory

The achievement goal orientation model posits that the purpose or goal that causes a person to engage with a task influences how they experience the task and the behaviors they exhibit in the pursuit of achievement (Elliot and Church, 1997). Initially, two goal orientations were identified based on whether a learner was seeking to develop competence or demonstrate competence. These orientations were labeled mastery and performance (Ames and Archer, 1988). Students pursuing mastery goals are motivated by developing competency and learning as much as they can about a subject, whereas students pursuing performance goals are motivated by demonstrating competency and skill in comparison to others. Later, achievement goal theorists further broke mastery and performance goals into approach and avoid orientations. Students pursuing mastery-approach goals are motivated by learning and developing as much as possible, while students pursuing performance-approach goals are motivated by demonstrating superior ability compared to peers and students pursuing performance-avoid goals are motivated by the desire to not look stupid or incompetent in front of others (Wolters, 2004). Some achievement goal theorists include a mastery-avoid goal orientation, where students are motivated by the desire to not miss out on learning what they can (Wolters, 2004), but this goal orientation is infrequently observed in learners (Senko, 2016).

Pure mastery and pure performance goal orientations have been demonstrated in controlled lab environments, but later studies show that in real world learning environments students tend to have both mastery and performance goals in varying degrees (Conley, 2012). While mastery goals are traditionally more often associated with adaptive learning strategies and performance goals with maladaptive learning strategies, some studies demonstrate that performance-approach goals can also be associated with high academic achievement and may not always lead to negative learning outcomes, particularly when combined with mastery goals (Conley, 2012; Harackiewicz, 1998). In some studies, students who "strongly endorsed both mastery and performance goals had higher levels of self-regulation and grades than students who endorsed only one or neither goal" (Harackiewicz, 1998). Because of this, Harackiewicz and her colleagues proposed a multiple goals theory to amend achievement goal theory, suggesting that mastery and performance goals are not mutually exclusive and that "mastery and performance goals can both initiate positive motivational processes" (Harackiewicz, 1998).

Achievement Goal Orientation theory also touches on goal *structures*, which is the environment of policy and practices that the learner is in, and how it affects the achievement goals of the learner. Mastery structure is an environment that espouses that learning is important and that anyone can work hard and be successful, whereas performance structure tells learners that success means getting rewards and outperforming others (Wolters 2004). Perceived goal structure of an environment has been shown to influence the individual achievement goal orientations of students (Wolters 2004).

Goal Orientations, Goal Structures, and Self-Regulated Learning

Mastery goal orientation is associated with adaptive learning strategies, behaviors, and mindsets, such as viewing challenges and failures as ways to learn and grow, help-seeking behavior, and deeper learning strategies (Conley, 2012; Harackiewicz, 1998). Having mastery goal orientation is strongly associated with the use of self-regulated learning strategies (Pintrich, 1999). On the other hand, performance goal orientations, particularly performance-avoid orientation, are associated with maladaptive behaviors such as self-handicapping, procrastination and avoiding challenges (Conley, 2012; Elliot and Church, 1997).

Pintrich (1999) examined the relationship between goal orientation and cognitive learning strategies, metacognitive learning strategies and self-regulated learning outcomes in both middle school and college students. He examined the cognitive learning strategies of rehearsal, elaboration, and organization. Rehearsal involves repeating aloud information to be learned, reading aloud from a text or underlining portions of a text, and is considered a more superficial level of processing. Elaboration strategies are considered deeper processing strategies and involve writing summaries, making analogies, comparing and contrasting ideas, and teaching ideas to others. Organization strategies are also considered deeper processing strategies and involve strategies such as outlining and generating idea-maps to connect and relate concepts to each other. Aside from cognitive strategies, Pintrich looked at metacognitive and self-regulation learning strategies such as planning and goal setting; monitoring one's behavior and understanding; and correcting deficits in behavior and understanding through regulating strategies such as revisiting material, slowing reading speed through difficult passages, and adjusting test-taking techniques to account for time remaining. Pintrich found

that mastery goals were strongly positively related to the use of advanced cognitive strategies and self-regulation behaviors in both middle school and college students, with the strongest relationship being between mastery goals and self-regulation in middle schoolers.

Goal structures is a term that describes how student goal orientations and learning strategies can be influenced by how they perceive their learning environment (Wolters, 2004). In a study examining the relationship between goal structures and students' personal goal orientations in junior high math class, Wolters (2004) found that students who perceived their learning environment to promote mastery goals tended to adopt mastery goals themselves and less frequently adopted performance-avoid goals. On the other hand, students who perceived their learning environment as promoting a performance-approach goal were more likely to adopt both performance-approach as well as performance-avoid goals for themselves. Not only that, but they found a positive correlation between student perception of mastery structure and effort, persistence, and use of cognitive and metacognitive learning strategies. They further found a negative correlation between student perception of mastery structure and procrastination and a positive correlation between performance-approach structure and procrastination. Likewise, Ames and Archer (1988) performed a study of 176 junior high and high school students, and found that when students felt that their classroom environment promoted mastery goals, they were more likely to prefer challenging tasks and use more effective learning strategies (e.g. planning, monitoring, and information processing strategies).

In a study of students in a college-level marketing course, Young (Young, 2005) examined the motivational effects of the learning environment in facilitating self-regulated learning. Like Pintrich, Young looked at rehearsal, elaboration, and organization as cognitive

strategies in learning, with rehearsal begin regarded as a superficial learning strategy and elaboration and organization regarded as deeper processing leading to long-term learning. Likewise, Young also identified the strategies of planning, monitoring, and regulating as self-regulatory strategies. Young found that instructor and learning climate were positively correlated with mastery achievement goal orientation in students, which in turn was positively correlated with intrinsic motivation in students and negatively correlated with extrinsic motivation. Intrinsic motivation was positively correlated with all cognitive and self-regulated learning strategies, whereas extrinsic motivation was only correlated with the use of the more superficial cognitive strategy, rehearsal, and not correlated with the other strategies, cognitive or self-regulatory.

The relationship between achievement goal orientations, perceived goal structure and students' use of adaptive or maladaptive learning strategies has borne out in the medical education setting as well. In their 2012 study, Artino et al. looked at medical students' perceptions of their learning environment as well as their learning strategies across the different stages of medical education. They found that students' perception of mastery goal structures positively correlated with metacognition (e.g. goal setting, planning, monitoring and regulation) and negatively correlated with procrastination and avoidance of help-seeking. Furthermore, they found that student perception of performance-approach goal structures correlated with higher medical school GPA but also with perceived performance-avoid goal structures, and student perception of performance-avoid goal structures positively correlated with help-avoidance and procrastination. Zheng et al. (2020) conducted research exploring the relationships among achievement goals, self-regulated learning behaviors and learning

performance in medical students in the context of clinical reasoning using a computer-assisted problem-based learning environment. They found that performance goals negatively influenced performance in clinical reasoning via negative correlations with efficacy and confidence, whereas mastery-approach goals were “directly associated with higher levels of self-regulated learning” leading to more positive learning outcomes.

In summary, perceived mastery goal structures are positively correlated with students’ personal mastery goal orientations, which in turn predict stronger use of deeper cognitive and self-regulated learning strategies. In contrast, performance goal structures were correlated with students’ personal performance goal orientations. While perceived performance-approach goal structures are positively associated with academic achievement, they are also associated with performance-avoid goal structures and performance-avoid orientations, which predict maladaptive learning techniques like procrastination and avoidance of help-seeking behavior.

The Present Study

Both medical and nonmedical education literature shows that mastery goal orientation is associated with adaptive learning techniques and that the perceived goal structure of a learning environment influences the achievement goal orientations of the students within that environment. Therefore, medical educators wishing to promote self-regulated learning among their students should strive to provide a learning environment that will promote mastery goal orientation. However, medical school curriculum is not the only factor in medical student motivation, as seen by the importance of obtaining a high score on Step 1 of the USMLE driving many students to forego the curriculum laid out by their schools in favor of a study plan aimed solely at maximizing Step 1 scores (Chen et al., 2019). Now that the NBME is transitioning from a summative three-digit performance score report to a pass/fail score report, medical educators have an opportunity to study the potential impact this change may have on medical students' goal orientations, perception of goal structures, and use of adaptive learning strategies. This author proposes the following study to compare the achievement goal orientations and perceived goal structures of students getting a three-digit score on Step 1 (students in class of 2024) to students getting a pass/fail score (students in class of 2025). This study would help expand the medical education field's understanding of achievement goal theory's role in the motivation and learning strategy use of medical students.

Research Questions

This study will seek to examine the following research questions:

1) What is the relationship between the grading structure of the USMLE Step 1 and preclinical medical students' perception of their learning environment's goal structure?

2) What is the relationship between the grading structure of the USMLE Step 1 and preclinical medical students' personal achievement goal orientations?

3) What is the relationship between the grading structure of Step 1 of the USMLE and the use of adaptive learning strategies (rehearsal, elaboration, organization, metacognitive self-regulation, effort regulation, and help-seeking) in preclinical medical students?

Methods

Participants

Participants of the study will be approximately 200 preclinical medical students at the University of Utah School of Medicine. This school is chosen due to its traditional curriculum consisting of two years of preclinical coursework graded on a pass/fail basis, followed by Step 1 and then two years of clinical rotations. Participants will be recruited from two cohorts: current students of the graduating class of 2024, who will be the last class to receive a three-digit performance score on Step 1 of the USMLE; and students of the graduating class of 2025, who will be the first class to receive a pass/fail score on Step 1 of the USMLE.

Measures

Students' Achievement Goal Orientations. Students' individual achievement goal orientations will be determined using the revised Personal Achievement Goal Orientation items in the Patterns of Adaptive Learning Scales (PALS) (Midgley et al. 2000) tool, a 14-item questionnaire using a 5-point Likert scale (1 = "Not at all true", 3 = "Somewhat true," and 5 = "Very true"). In this questionnaire, five items assess mastery-approach goal orientation (e.g. "One of my goals in class is to learn as much as I can"), five items assess performance-approach

goal orientation (e.g. “One of my goals is to look smart in comparison to the other students in my class”), and four items assess performance-avoid goal orientation (e.g. “It’s important to me that I don’t look stupid in class”). The 14 items will be presented in a random order on the questionnaire. Mastery-avoid goal orientation will not be measured, as it is less frequently seen among students.

Student Perception of Goal Structure. Student perception of goal structure in medical school will be determined through the use of the Perception of Classroom Goal Structure items in the PALS tool. This is a 14-item questionnaire using a 5-point Likert-type scale (1 = "Not at all true,” 3 = "Somewhat true,” and 5 = "Very true”). In this questionnaire, there are: 6 mastery goal items to assess students’ perceptions that *developing competence* is the purpose of pursuing academic tasks in medical school (e.g. “In medical school, really understanding the material is the main goal”); 3 performance-approach goal items to assess students’ perceptions that *demonstrating competence* is the purpose of pursuing academic tasks in medical school (e.g. “In our medical school, getting good grades is the main goal”); and 5 performance-avoid goal items to assess students’ perceptions that *not demonstrating incompetence* is the purpose of pursuing academic tasks in medical school (e.g. “In medical school, it’s important not to do worse than other students”). The 14 items will be presented in a random order on the questionnaire. For validation and reliability of the PALS tool, see Anderman et al. (2003).

Student Self-Regulated Learning Strategies. Student learning strategies will be determined through the use of learning strategy items on the Motivated Strategies for Learning questionnaire (MSLQ) (Pintrich 1991), using a 5-point Likert scale (1 = “Not at all true of me”, 7 = “Very true of me”). Specifically, the author will use the 12-item metacognitive self-regulation

scale (e.g. “When studying for medical school I try to determine which concepts I don't understand well”), the 4-item rehearsal scale (e.g. “When studying for medical school, I read my notes and the course readings over and over again”), the 6-item elaboration scale (e.g. “I try to apply ideas from course readings in other class activities such as lecture and discussion”), the 4-item organization scale (e.g. “When I study for medical school, I go over my class notes and make an outline of important concepts”), and the 4-item help-seeking scale (e.g. “I ask the instructor to clarify concepts I don't understand well”). A validation study has shown that the MSLQ is reliable and predicts meaningful outcomes in a medical education setting (Cook et al. 2011).

Procedure

Students will be recruited at the beginning of their second year of medical school. Second year was chosen as it is the year of preclinical coursework leading up to the administration of Step 1, and the class of 2024 has already completed most of their first year. Student participation will be entirely voluntary and have no impact on their grades or evaluations. Questionnaire responses will be anonymous. Participants from both the class of 2024 and the class of 2025 will take the PALS and MSLQ questionnaires during the first week of second year and again at the end of second year closer to the time they will take Step 1. Questionnaire results will be averaged across each cohort and the averages will be used to compare results between the two classes. Independent samples *t*-tests will be used to compare the two groups on the outcomes (perceptions of achievement goal structures, personal achievement goal orientations, and use of adaptive learning strategies for Research Questions 1, 2, and 3, respectively).

Expected Results

Research Question 1: What is the relationship between the grading structure of the USMLE Step 1 and preclinical medical students' perception of their learning environment's goal structure?

I expect to find a statistically significant difference in scores on the Goal Structure PALS between students with a tiered grading structure for Step 1 (class of 2024) and students with a pass/fail grading structure for Step 1 (class of 2025). Specifically, I expect that students who have a pass/fail grading structure for Step 1 (class of 2025) will score higher on the mastery goal structure items and lower on both performance-approach and performance-avoid items than students who have a tiered grading structure for Step 1 (class of 2024).

Research Question 2: What is the relationship between the grading structure of the USMLE Step 1 and preclinical medical students' personal achievement goal orientations?

I expect to see similar results as expected in the first research question, where students with a pass/fail grading structure for Step 1 (class of 2025) will score statistically significantly higher on the mastery orientation items and lower on both the performance-approach and performance-avoid orientation items than students with a tiered grading structure for Step 1 (class of 2024). I expect the difference to be greater for performance-avoid orientation items than for the performance-approach orientation items given past results from research on the relationships between mastery goal orientations and performance-avoid orientations (Wolters, 2004).

Research Question 3: Is there a relationship between grading structure of Step 1 of the USMLE and the use of adaptive learning strategies (rehearsal, elaboration, organization,

metacognitive self-regulation, effort regulation, and help-seeking) in preclinical medical students?

I expect that students with a pass/fail grading structure for Step 1 (class of 2025) will have statistically significantly higher usage of adaptive cognitive learning strategies (rehearsal, elaboration, organization), metacognitive self-regulatory learning strategies, and help-seeking behavior than students with a tiered grading structure for Step 1 (class of 2024).

Conclusion

Past research has shown that mastery goal orientation is correlated with more intrinsic motivation and more adaptive learning strategies (Senko 2016; Ames and Archer 1988, Pintrich, 1999). Past research has also shown that perceived goal structures are related to learning strategies and that mastery goal structure is positively correlated with self-regulated learning strategies not just in education in general (Ames & Archer, 1988; Wolters, 2004) but medical education specifically (Artino et al., 2012; Zheng et al., 2020). Clearly, if medical educators wish to foster self-regulated learning in their graduates, then encouraging mastery goal orientations through the use of mastery goal structure is within their best interests. However, promoting a mastery goal structure through medical school procedures and policies can only go so far when so much of a student's future rides on factors outside of an individual school's control, such as the weight USMLE Step scores have on future residency prospects. The change to pass/fail grading on Step 1 may potentially contribute to the goal of creating physicians who can self-regulate their learning.

This period of transition gives medical educators a unique chance to observe how much of an impact Step 1 had on student motivation. Much discussion has been had on the potential effect that this shift will have on student psychological well-being and academic achievement, but there has been little discussion on how this change will influence student motivation within the framework of achievement goal theory. This proposed research project aims to take advantage of this opportunity by examining the effects of the change to pass/fail score reporting for the USMLE Step 1 on the achievement-related motivations of medical students, and if the change will lead to an increase in medical students' perceptions of mastery goal

structures, personal mastery goal orientations, and cognitive and metacognitive self-regulated learning strategies. The results of this proposed study will help answer the question as to whether this change will be perceived by students as a mastery-oriented learning environment and thus potentially influence their own achievement goals and use of adaptive learning strategies. The results can also inform future discussion on the merits of pass/fail grading for Step 1, as well as future discussion on the grading structures of other portions of the USMLE (Step 2 and Step 3), which are still currently graded with summative, three-digit performance scores.

As outlined in the expected results section, I expect that students who are taking USMLE Step 1 as a pass/fail exam will be more likely to have more mastery-oriented achievement goals than students who received a three-digit performance score on the exam. I expect that this will in turn lead to increased usage of adaptive learning strategies such as elaboration, organization, and help-seeking behavior, as well as increased usage of the self-regulatory processes of planning, monitoring, and regulation. Giving students a ranked three-digit score on Step 1 allows for residency directors to compare scores among applicants, which puts pressure on students to maximize their test score. The importance of these scores in residency hiring practices makes it imperative for students to not just pass the test, but to get as high as possible or risk being passed over for their dream specialty or residency program. In this learning environment, mastering concepts and developing clinical skills takes a back seat to memorizing minutia to outperform peers. By making the exam a pass/fail exam, this performance-oriented pressure is lessened; while there is still pressure to pass, the bar to demonstrate necessary competence for licensure is much lower than the current bar to be a

"competitive applicant," and once attained, the student can then focus on mastering the content and understanding the bigger picture instead of memorizing facts for an exam. This focus on mastery and understanding may lead to better self-regulated learning skills as students are trying to learn deeply and synthesize material.

If my expected results are correct, then it may indicate that the grading systems of the other parts of the USMLE Step exams, particularly Step 2, should also be revisited. As it stands, while residency program directors will no longer be able to use Step 1 as a standardized measurement of student knowledge and ability, that role will likely fall to Step 2, which is typically taken after core clinical rotations have been completed. If this is the case, the impact of changing Step 1 to pass/fail may be attenuated by the fact that the pressures and influences on student well-being and motivation will come from Step 2 instead. If Step 2 remains scored with a three-digit performance score, medical students' perception of goal structures may not change as much as anticipated. Students from both classes may be neither purely mastery nor purely performance oriented, but to exhibit multiple goal orientations as described by the multiple goals theory (Harackiewicz, 1998). The "Step 1 Climate" may instead morph into a "Step 2 Climate," complete with a new parallel curriculum and sustained performance goal orientations.

Testing plays a major role in medical education, from medical school admissions to passing classes and clerkships, licensing, and continuous certifications. It is unlikely that testing in medical education will go away, and there will always be pressure to pass exams or to demonstrate knowledge and skills (or avoid demonstrating lack of knowledge or skills) in front of the clinical team. It therefore may never be possible to have a learning environment that is

totally mastery focused nor students who are completely mastery oriented. However, by making the learning environment less competitive and performance-focused, mastery orientations can be strengthened, and the negative motivational effects of performance goal structures can be mitigated.

If my expected results are correct, future research should be done to investigate whether these changes in student motivation and learning strategies persist throughout medical education and into full practice as a physician. The preclinical learning environment is only one aspect of the training experience of a physician, and the environment of the undergraduate clinical years and residency training may exert a powerful influence on the motivation and learning habits of the trainee and practitioner. The two cohorts studied in this proposed research project could be followed throughout the different stages of their training to see if any differences in their personal achievement goal orientations and use of adaptive learning strategies are sustained. Points of interest in training include undergraduate clinical rotations, preparing for other parts of the USMLE, entering and completing residency, and years into full practice. If mastery goal orientations or adaptive learning strategies regress at any point, it can be identified and the cause examined for potential areas of intervention.

If my expected results are not correct, it could imply that Step 1 does not have as much an influence on medical student motivation than previously assumed. It could imply that the three-digit grading system of Step 1 does not actually exert a meaningful performance goal structure, or other performance-focused aspects of medical training are sufficiently influential to overcome whatever potential motivational benefits can be gained from changing Step 1 to pass/fail. If subjects' perceptions of goal structures/personal goal orientations shift toward

mastery but learning strategies don't change (or vice versa), it may mean that the relationship between achievement goal theory and self-regulated learning is not applicable in this context. This would help inform any future discussion on the merits and drawbacks of keeping the Step 1 grading change or potentially making a similar grading change to Step 2 as well.

This study faces several limitations. It relies on voluntary participation and self-reporting through surveys, which introduces potential biases such as self-selection bias and social desirability bias. I will attempt to mitigate social desirability bias by protecting participants' privacy, but some bias may remain. Furthermore, there may be baseline differences in goal orientations and use of learning strategies between the two classes. Ideally, this difference will be controlled for by obtaining baselines for each cohort before they begin medical school. However, the class of 2024 has already matriculated and begun medical school coursework. Thus, their goal orientations may have already been influenced by their learning environment and a baseline is unobtainable. Samples of students from the University of Utah may not be representative of the medical student population nationwide, thus findings of this study may not be generalizable to the wider medical education system. While future research could incorporate a multi-institutional approach, the window in which to compare students pre- and post-grading system change is narrow and may not be feasible in the future.

It should be noted that this proposed study is meant to be performed in a medical school with a traditional 2-year preclinical, 2-year clinical curriculum. In such a curriculum, USMLE Step 1 is taken after two years of preclinical education, before students begin their clinical rotations in hospitals and outpatient clinics. However, some schools have students starting their clinical experiences before they take Step 1, starting as early as the beginning of

their second year. In such cases, the learning environment during the second year of medical school leading up to Step 1 is typically very different from the learning environment in the second year at a traditional program. The different duties, expectations, and learning settings in clinical rotations may mean that the change to Step 1 score reporting may have a different effect on the academic motivations and achievement goal orientations of those students. Because of this, results of this study may not generalize to students attending schools with alternative curricula.

Ultimately, this period of transition offers academic medicine the unique opportunity to explore how this change will impact not just student well-being and academic achievement, but also their motivations and learning strategies. This study will help advance the field's understanding about achievement goal theory and goal structures in preclinical undergraduate medical education, and better understanding will lead to more informed choices about what institutional changes can be made to achieve the important goal of a life-long, self-regulated physician learner.

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