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The Correlation of Academic Credentials and other Parameters with Freshman Medical Student Motivation

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Abstract

Over 30 years of personal observation as an instructor of anatomy and/or an associate dean, shows some students with excellent academic credentials perform poorly in medical school and vice versa. Conversations with students reveal one apparent factor for success in medical school is the level of student motivation. This study was performed to quantify this observation by measuring intrinsic, extrinsic and amotivational factors for medical school success. At the end of the first year of medical school, 147/174 students from the class of 2016 at a southcentral USA medical school voluntarily completed the Academic Motivation Scale (AMS) to determine if any of the AMS subscale scores were correlated with undergraduate or first medical school year academic success, desired specialty choice, or if motivation came from close family members who are physicians. The data had a Cronbach alpha of .88. Undergraduate GPA was negatively correlated with the intrinsic-stimulation subscale. The Medical College Admissions Test (MCAT) writing score was positively correlated with the intrinsic-accomplishment and extrinsic-introjection subscales. Other MCAT subscale scores and undergraduate grade point average (GPA) did not correlate with any of the other motivation subscales. Percentile grades on first year medical school basic science classes had no correlation with any motivation subscale, nor did having close family members as physicians. A negative correlation with the intrinsic-stimulation subscale suggests the experience of maintaining a high undergraduate GPA does not induce pleasure or excitement in the experience. Extrinsic motivation did not correlate with undergraduate GPA or with freshman medical school basic science grades. Men show greater amotivation than women, inferring female freshman medical students are more motivated to succeed. In conclusion, students with poorer academic credentials before entering medical school, or after receiving their first-year grades, are just as motivated as those students who are higher performers.

Keywords: MCAT, GPA, Medical students, Intrinsic motivation, Extrinsic motivation, Academics, Medical education.

Introduction

Motivation, as defined by the "self-determination theory" [1,2], can come from either intrinsic or extrinsic sources, and these two types of motivation can be broken down into several subtypes. In general, the more interesting a task is to an individual the more intrinsic motivation becomes important, which results in a positive outcome for the task; conversely, if a task is less interesting, or even dull, intrinsic motivation becomes less relevant and extrinsic motivation leads to more positive outcomes. In the field of medical education, intrinsic motivation

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is a better predictor of academic success vs. extrinsic motivational factors. However, a small number of students lack extrinsic or intrinsic motivation and are amotivated in medical school [3].

Since motivation is directly related to self-determination, the degree to which a person is self-determined to succeed can be derived by examining the answers to the Academic Motivation Scale (AMS; developed by Vallerand et al. [4]), especially via the intrinsic-motivation and identified-regulation subscales [2,5]. The trait of self-determination is increased if the person finds themselves in an environment which supports the person's psychological needs. Therefore, the motivation of a person will be optimal if the environment allows the experience of feeling competence, autonomy and relatedness toward a given task. Motivation is also determined by whom you know and how supportive they are for your cause. Ergo, the reason this study looked for a correlation between medical student motivation and how many of their family members were also physicians.

An extensive literature review by Kusurkar and colleagues [6] show there are a number of independent and dependent variables which determine the types of motivation a medical student possesses. The review showed that some studies reveal significant correlations between various personality traits and other factors regarding motivation and academic success, while other studies failed to find significant correlations between types of motivation and academic success. This current study, using the AMS, was performed to determine the degree of student motivation in the first year of undergraduate medical school vs. various factors shown to influence motivation and academic performance. The underlying hypothesis being students with lower academic credentials or and/or having a poorer performance on first year basic science courses would have significantly higher motivation scores than those students with better incoming credentials and better first year basic science course grades. The data generated in this study can help shed light on previous studies which show variable results regarding the factors which influence the types of motivation used by medical students.

Materials and Methods

Cohort and statistics

This IRB-approved study (protocol #136861), took place at a medical school in southcentral United States, the University of Arkansas for Medical Sciences (UAMS). In the graduating class of 2016, 147/174 (84.5%) first year, allopathic medical students voluntarily completed the AMS [4]. The cohort was 60.5% male (n=89) and 39.5% female (n=58). Results taken from the AMS scale were compared to undergraduate GPA, the MCAT total score, MCAT subscale scores, final percentile first year course grades (cell biology, biochemistry, gross anatomy, physiology and histology), choice of desired medical specialty, and number of siblings, parents or grandparents who are physicians.

AMS subscale scores were combined to reduce the number of constructs so as to provide a "self-determination index" (guidelines via Vallerand et al. [2]). The higher the AMS score, the more determined the person is to succeed at a particular task. Kolomogorov-Smirnov and Shapiro-Wilk tests revealed the data had a non-normal distribution which resulted in the use of the non-parametric Mann-Whitney U test. Statistical analyses were performed using the IBM SPSS Statistics package.

Academic motivation scale

The AMS divides motivation into seven components [4]. There is **Intrinsic Motivation (IM):** "Doing an activity for itself, and the pleasure and satisfaction derived from participation." Intrinsic motivation is subdivided into three subtypes.

IM–knowledge: "The fact of performing an activity for the pleasure and satisfaction one experiences while learning, exploring, or trying to understand something new." A student may be intrinsically motivated by knowing it is an enjoyable experience to be exposed to something new when reading a book.

IM–accomplishment: "The fact of engaging in an activity for the pleasure and satisfaction experienced when one attempts to accomplish or create something." There are students who go above and beyond set requirements in order to experience the gratification of attempting to surpass themselves.

IM–stimulation: "Engagement in an activity in order to experience stimulating sensations (e.g., sensory pleasure, aesthetic experiences, fun and excitement) derived from one's engagement in the activity." An example is a student who goes to class to experience the excitement of stimulating class discussions.

There is **Extrinsic Motivation (EM):** "Behaviors which are engaged in as a means to an end and not for their own sake". Extrinsic motivation is also divided into three subtypes.

EM–External Regulation: "Behavior regulated through external means such as rewards and constraints." A student may say, "I study the night before exams because my parents force me to."

EM–Introjected Regulation: "The individual begins to internalize the reasons for their actions. However, this internalization is not self-determined since it relays on past external contingencies." A student may say, "I study the night before exams because that's what good students are supposed to do."

EM–Identified Regulation: "A behavior becomes valued and judged important, especially when it is perceived as chosen by oneself, then the internalization of extrinsic motives becomes regulated via identification." A student may say, "I've chosen to study tonight because it is something important for me."

Finally, there is **Amotivation (AM):** "Amotivation occurs when a person does not perceive contingencies between outcomes and their own actions. They are neither intrinsically nor extrinsically motivated. They feel their behaviors are caused by forces out of their own control. Eventually they

may stop participating in academic activities." A student may say, "It doesn't matter how hard I study, I'll never make a high score.", or "I know I won't pass the exam."

Medical specialties

The first-year students were asked to select a single preferred choice from a list of 23 medical specialties they would like to enter. The specialties were divided into those that had a large amount of patient contact and continuity of care, i.e., family and internal medicine, pediatrics, OB/GYN and psychiatry, vs. the remaining 18 specialties which were more technically-oriented and/or had very little or no patient contact, e.g., radiology, surgery, anesthesiology and emergency medicine.

Medical college aptitude test (MCAT)

During the time these students took the MCAT (prior to 2013), there were four different categories, biological sciences, physical sciences, verbal reasoning and a writing sample. Scores could range from 3-45 in the combined first three categories, with writing scored on a separate alphabetic scale from a low of "K" (score of 11) to a high of "S" (score of 19). Note: In 2015, the MCAT dropped the writing component, changed their exam categories and how the scores are presented.

Results

None of the AMS subscale scores had a significant correlation with the desired residency choice, whether it be the five specialties with continuity of patient care (n=52, 35.3%) or the remaining 18 which were more technically-oriented or had little or no patient contact (n=95, 64.7%). The five most preferred specialties among first year medical students were emergency medicine (n = 19), pediatrics (n=19), orthopedic surgery (n=15), family medicine (n=13) and internal medicine (n=12). In addition, the presence of any type of close family member who was a physician (n=35, 23.8%) had no significant impact on AMS scores vs. those students who did not have a family member in the medical profession (n=112, 76.2%). Out of the 35 first year medical students with a close family member physician, 28 of them had either one or both parents as physicians.

Undergraduate degree GPA (range 2.60–4.00; mean=3.67 ± 0.32) was statistically negatively correlated with the intrinsic-stimulation subscale, r=-0.26 (α=0.05). However, none of the motivation subscales had any significant correlation with grades achieved for first year basic science courses, regardless of whether the medical student was a high (≥ 85% for a final course grade) vs. a low (≤ 84% as a final course grade) academic achiever. First year medical school GPAs ranged from 4.00–1.95, with a mean of 3.20. Biochemistry grades ranged from 67.6%–97.8%; cell biology from 59.5%–100%; gross anatomy from 61.4%–93.8%; histology from 73.3%–98.6%; and physiology from 60.0%–98.3%.

The total MCAT score (mean=29.17/45.00 ± 2.89; range 21–37) was not significantly correlated with any AMS subscale or with undergraduate GPA. However, the MCAT writing subscale score (mean=14.77 ± 1.99; range 11–19) was statistically significantly correlated with the intrinsic-accomplishment subscale, r=0.197 (α=0.01), and with the extrinsic-introjection subscale, r=0.16 (α=0.05).

Regarding potential sex differences in AMS subscale scores, there was a statistically significant difference between men (4.51 ± 4.24, n=88) and women (4.24 ± 4.24, n=59) on the amotivation subscale, with women scoring lower than men, p<0.047. Women also scored significantly higher than men on the self-determination index (22.50 ± 4.06 vs. 20.45 ± 6.16, respectively; U=2000.5, p=0.019).

There was no significant correlation between extrinsic-external regulation subscale and intrinsic-knowledge subscale scores. The amotivational subscale was only significantly correlated with intrinsic-knowledge subscale, r=-0.17 (α=0.05) and extrinsic-external regulation subscale, r=0.17 (α=0.17).

Discussion

AMS vs. specialty choice

The current study showed this cohort of students had no correlation between various motivation scores and the desired specialty choice. However, other studies show motivation does play a role in what student's desire as a specialty [6,7]. Students selecting primary care specialties are more "people-oriented" and driven by intrinsic motivational factors; whereas, those students who desire more technically-oriented specialties with little patient contact are driven by both intrinsic as well as extrinsic motivational factors, such as lifestyle, financial reward and prestige [8]. Studies by Newton and colleagues [9–11] show women, more than men, tend to select primary care specialties where there is a high degree of patient contact and continuity of care, and that this is correlated with women having higher empathy scores than men. Those results are in agreement with motivational studies indicating women prefer people-oriented specialties, while men prefer more technically-oriented specialties [6,7,12].

AMS vs. physician relatives

This study shows having one or more family members who are physicians had no impact upon motivation scores. This supports the studies by Shawwa et al. [13] and Vaglum and colleagues [7], but contradicts the findings of Alfayez et al. [14]. The results of these studies probably differ because of cultural differences, since they were performed in the USA, Europe and Middle East. Other studies indicate that students who perceive a high degree of parental support and/or early clinical exposure, leads to higher intrinsic motivation [6,15].

AMS vs. academics

Because medical students are inherently intelligent, it should not be surprising that the data from this and many other studies show no strong correlation between motivation and undergraduate GPA [16,17]. The same holds true for freshman basic science course grades [18]. This lack of correlation is not always true, since other studies have shown a correlation between undergraduate grades and motivation [6,19]. In studies where there is no correlation,

there is undoubtedly a ceiling effect since almost all students receive a final percentile grade equivalent to an "A" or "B". However, it has been shown if a student does poorly on a task, this is a motivating factor to improve performance on the next related task [20]. Therefore, even a student achieving at a "C", vs. an "A" or B" level grade should be motivated to compensate for their short-comings to improve their performance in that subject on the next examination. If they do well on the next examination this enhances their motivation by realizing that achieving success, i.e., earning a higher score, is possible. The lack of correlation of motivation with grades follows a similar pattern which shows the variability of how undergraduate GPA and MCAT scores predict medical student success. Students with low GPAs and/or MCAT scores can still succeed in medical school – albeit at a lower rate than students with high GPAs and MCAT scores [21]. As additional evidence, the author examined 15 years-worth of MCAT and undergraduate GPA vs. medical student performance at UAMS.

The type of curriculum has been shown to have a bearing on which types of motivation a student uses while studying [22]. The students in this cohort, who studied in a traditional course-based curriculum, are more likely to be extrinsically-motivated since their leaning environment is highly regimented. This is in contrast to a problem-based learning (PBL) curriculum where there is considerable autonomy of learning by the student who relies on intrinsic motivation to do well. In addition, the students in this cohort received grades based on an A-F scale vs. an honors system where a student can receive a grade of honors, satisfactory or unsatisfactory. It has been shown that an honors system-based grading may negatively influence motivation. Whereas, at the beginning of medical school receiving honors has an extrinsic motivating force, if a student does not receive honors grades in their early coursework they may become amotivated over time by a feeling of incompetence to compete with other students at an honors level [22,23].

The negative correlation between undergraduate GPA and the intrinsic-stimulation subscale infers the hard work needed to obtain a high GPA was not stimulating or "fun", therefore, student success was not related to enjoyment of the activity. The lack of such a correlation with the freshman grades infers that obtaining good medical school grades was more stimulating than achieving good grades as an undergraduate student– but not to the point of statistical significance in medical school. The desire to study, although it's hard work, is still subject to intrinsic motivations of having an interest in medicine, a sense of achievement as well as becoming an indispensable member of society.

AMS vs. MCAT writing score

Prior to 2015, when the MCAT had a writing component, there was a significant correlation between the MCAT writing score with intrinsic-accomplishment and extrinsic-introjection. This correlation infers the act of creating prose is satisfying to the student. Being able to write clearly goes hand-in-hand with being able to verbally communicate clearly. Good communication skills are essential in forming a physician-patient empathic bond of trust, and is a fundamental trait patients look for in what they consider to be "good" physicians [24]. In contrast, an extremely competent physician who has poor communication/empathic skills may not be viewed in a favorable fashion [25]. In this regard, studies show women, more than men, have a stronger desire to help others and have greater altruistic, pro-social attitude, vs. having status/prestige or financial security as a primary motivator for entering medical school (cf. ref. 6). These findings are in concert with prior studies showing that women consistently have larger scores on empathy survey instruments than men [9–11,25].

Amotivation and self-determination

The data show that men score higher on the amotivation subscale than women. This has an impact on the degree to which a student masters the material. Amotivated students tend to have a more superficial understanding of the material and are less likely to continue their studies, vs. motivated students who undergo deep learning and complete their medical education [3]. A study from Brazil supports the current finding that men had significantly larger amotivation scores than women [3]. Twenty-five years of personal observations at UAMS show that men, more than women, are more likely to drop-out of medical school. Finally, the self-determination index data show women are more driven to succeed in medical school than men, and other studies support this result [cf. ref. 6].

Of note is that the current 2018 medical student population, vs. the cohort examined in this study, who matriculated in 2012, may not have the same response to intrinsic and extrinsic motivational factors. Borges and colleagues [26] showed that their "Generation X" matriculants (1995, 1996) were more motivated by the prospect of power, vs. the "Millennial" matriculants (2003, 2004) who were more motivated by achievement and affiliation. Millennials also score higher on traits such as self-satisfaction, high expectations and desire for leisure when compared to past generations [27]. Thus, each successive generation of medical school applicants may display different motivational factors for entering medical school which may impact their choice of resident specialty upon graduation. For example, current medical students make "lifestyle" one of their priorities when selecting a residency.

Conclusion and Limitations

Motivation plays a large role in our lives, and the pursuit of higher education is no exception. Motivation is related to various factors such as curiosity, persistence, learning and performance. In essence, this study showed that all the medical students were highly motivated regardless of their entering credentials or first year academic performance. As such, an individual's motivation is most likely dependent upon both intrinsic as well as extrinsic factors, which are interwoven in a complex fashion malleable by both conscious and unconscious decisions and societal pressures. Yet, the admissions process for selecting medical students obviates some of these variables by preferentially selecting applicants who have already demonstrated a high degree of motivation, thereby artificially skewing the results of any

motivation survey instrument given to medical students towards higher motivation scores [6,28].

Thus, the hypothesis that students with lower academic credentials would show a higher degree of motivation has not been supported. Furthermore, the acquisition of high grades in the freshman year of medical school by the vast majority of students confounded any potential significant findings. The lack of discrimination between potentially poorer performing students and the high achievers is a limitation of this study and makes interpretation of the results difficult because of a ceiling effect. Another limitation is that the cohort is composed of students from one freshman class at a single allopathic medical school.

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