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Original Research

A Study on Predicting High Achievers among Medical Students in the 4th Semester Faculty of Medicine Universitas Airlangga

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ABSTRACT

Introduction Student-centered learning (SCL) is based on students' needs, capacities, and other characteristics, making the method more personalized. This study aimed to analyze new questionnaires to categorize 4th-semester medical faculty students based on their characteristics. Understanding these characteristics could make the teaching and learning process more effective, potentially reducing the number of students retaking exams.

Material and Methods: Subjects were 4th semester students who agreed to enroll and self-fulfilled the questionnaire. High achievers are defined as high expectations and consistent high performance (GPAs). Validity and reliability of each item were analyzed by statistical calculations accordingly. GPA in the next semester was used as threshold to confirm the participant's categorization.

Results: The study commenced in March 2022, with 107 participants with Grade Point Averages (GPAs) available. The study demonstrated that the questionnaires had high validity and reliability (p-value < 0.005; Pearson Correlation Coefficient and Cronbach alpha). Among the participants, 3 (2.8%) were classified as high achievers, while 3 (28%) were categorized as low achievers. Notably, 44.86% of participants reported their passions as unrelated to medicine, while 5.61% were uncertain of their passions. Regarding vocation, 8.2% cited parental influence, and 10.3% felt their educational progress was not within their control.

Conclusion: The questionnaires had high validity and reliability in item analysis. There were 2,8% of participants predicted as High Achievers and Low Achievers. Refinements of items and score presentation are needed. Follow-up activities should be given to the low achievers to prevent becoming retakers.

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INTRODUCTION

Various efforts have been made to improve the quality of university graduates, including medical/specialist education and their effectiveness. To make understanding easier, this effort includes 6 variables of Medical Education, namely 1) Participants (Learners, students), 2) Lecturers, 3) Methods, 4) Learning materials, 5) Academic atmosphere (environment/atmosphere), and 6) specifically for medical education is the presence of patient [1]. Student-centered learning (SCL) which is mandated by educational law, various institutions and medical education experts, is implemented in various forms but

what is used here is "Education that is based on/according to the character/needs of participants as defined by various experts and the main author [2–9].

We elaborate on SCL to categorize participants as high achievers and low achievers based on the degree of self-awareness/ esteem, understanding of the education process, comprehension of learning mechanisms, and adoption of personal strategies for undertaking education (high expectation) and consistent high performance (GPAs). This categorization can be achieved by questionnaires that combine items in motivation, self-awareness, readiness, and other questionnaires [10–20]. These questionnaires can bridge the previous ones, which were not designed to predict achievement, even though some studies attempt to correlate them [21–26]. We hypothesized that these questionnaires can predict high achievers and low achievers, enabling us to gather data to perform follow-up activities, especially for the low achievers.

This study aims to develop new questionnaires to categorize participants into high and low achievers based on the degree of self-awareness, understanding of the educational process, comprehension of learning mechanisms and adoption of personal strategies for undertaking education, and to perform item analysis.

MATERIAL AND METHODS

Descriptive – cross sectional study. The subjects were 4th-semester students from the Faculty of Medicine who agreed to participate. They completed questionnaires consisting of 38 items to be answered (11 open-ended questions and 27 Likert scale), along with one for their Grade Point Average (GPA). High achievers were defined as individuals demonstrating deep self-awareness/ esteem, a profound understanding of the educational process, comprehension of learning mechanisms (atmosphere), and the adoption of personal strategies for undertaking their studies, coupled with consistent high performance in terms of GPA.

The duration for completing the questionnaires, as well as the validity and reliability of each item, was analyzed using statistical calculations. The GPA in the following semester served as a threshold to confirm the participants' categorization. Ethical clearance was obtained from the ethics committee of the Faculty of Medicine. Statistical analysis using Pearson correlation test for questionnaire item validity and calculation of Cronbach's alpha coefficient for questionnaire reliability were performed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, N.Y., USA) [21,27,28].

This research has obtained ethical exemption from the Health Research Ethics Committee of Universitas Airlangga School of Medicine, reference number 32/EC/KEPK/FKUA/2022, on February 8, 2022.

RESULTS

The study commenced in March 2022, involving 109 participants, with 107 providing their Grade Point Averages (GPAs). Questionnaire completion durations ranged from 52 seconds to 4 days and 4 hours, with the majority being in the range of 11 to 20 minutes.

There were 2,8 % categorized as High achievers and 2,8 % as Low achievers, Table 1 showed the data. The questionnaire was tested for validity using Pearson Correlation test, resulted in valid questions (each questions' p-value was <0.005). The questionnaire's reliability of all questions was very high. Reliability tests were also applied to clustered questions, that were self-awareness/ esteem, educational atmosphere and having personal strategy. The results are shown in Table 2.

Female versus male: 66 vs 41 participants, 44.86% of participants reported a passion unrelated to medicine, while 5.61% were uncertain of their passions. Regarding vocation, 8.2% cited parental influence, and 28% acknowledged not being the most influential figure in achieving their educational goals. Additionally, 10.3% felt their educational progress was beyond their control. Only 6.4% reported having a strategy to reach their goals, with an additional 6.4% considering such strategies as unimportant. Furthermore, 4.6% stated that their ongoing education was not the most influential phase of their future.

DISCUSSION

Artino, *et al* [27] wrote a systematic, seven-step process for designing high-quality questionnaires, with particular emphasis on developing survey scales that unfortunately, because the processes used to develop questionnaires vary in quality and lack consistent, rigorous standards.

We undertook these seven steps, with the first step as follows: there are already some existing questionnaires to assess motivation, readiness, personal awareness/esteem & strategy, but they are not aimed directly at predicting students' achievement. Questionnaires like the Big Five Personality Test, Myers-Briggs Type Indicator, StrengthsFinder, Holland Code, and Self-Directed Search are primarily designed to assess personality traits, preferences, and career interests rather than directly predict high achievers in academic settings [25]. Motivation questionnaires such as the Academic Motivation Scale (AMS), Motivated Strategies for Learning Questionnaire (MSLQ), Work

Table 1. Result of Each Categorisation

GPA (Performance)	Category	Self Awareness/ Esteem	Atmosphere (Process and Learning Mechanism)	Having Personal Strategy	Expectation (Sum of 3)
>3.97	H	3	4	9	3
	A	6	7	2	6
	L	2	0	0	2
3.1 – 3.97	H	55			
	A	32			
	L	6			
<3.1	H	2	2	4	4
	A	1	1	0	0
	L	0	0	0	0

Tabel 2. Questionnaire Item Validity and Reliability

Cluster of Questions	Validity p-value	Reliability (Cronbach's alpha)
All questions	Each question $p < 0.005$*	0.910
Self-awareness / esteem		0.785
Educational atmosphere		0.867
Having personal strategy		0.736

**Significantly valid*

Preference Inventory (WPI), Achievement Motivation Inventory (AMI), Self-Regulation Questionnaire (SRQ), Motivation Assessment Scale (MAS), and Medical Student Motivation Questionnaire (MSMQ) also are primarily designed to assess various aspects of motivation among students, including their drive, interest, and persistence in academic tasks. Dundee Ready Education Environment Measure (DREEM) questionnaire is not designed to predict high achievers directly [22,25]. Instead, it assesses the educational environment and student perceptions within medical education settings. Questionnaires like the Learning and Study Strategies Inventory (LASSI), Approaches to Studying Inventory (ASI), Learning Style Inventory (LSI), Study Process Questionnaire (SPQ), Motivated Strategies for Learning Questionnaire (MSLQ), Inventory of Learning Processes (ILP), and Study Habits Inventory (SHI) are primarily designed to assess students' learning strategies, approaches to studying, learning styles, and study habits rather than directly predict high achievers. Questionnaires like the General Health Questionnaire (GHQ), Perceived Stress Scale (PSS), Brief COPE, Brief Resilience Scale (BRS), Life Orientation Test-Revised (LOT-R), Connor-Davidson Resilience Scale (CD-RISC), Self-Compassion Scale (SCS), and Well-being Index are primarily designed to assess various aspects of personal well-being, stress management, coping strategies, resilience, and self-compassion. While Myers-Briggs Type Indicator etc, AMS etc, DREEM etc, LASSI etc, GHC etc provide valuable insights into the learning atmosphere and student experiences, they do not have the specific purpose of predicting individual academic performance or identifying high achievers [19,21,22,25]. Again, this new questionnaire is being developed to predict high achievers and low achievers, enabling interventions to prevent/reduce retakers. This is because the existing questionnaires have different purposes, such as assessing readiness, learning environment, motivation, or learning styles, and are not aimed at predicting high/low achievers [29].

The study demonstrated high validity and reliability (p-value < 0.005; Pearson Correlation Coefficient and Cronbach alpha). Among the participants, 3 (2.8%) were classified as high achievers, while 3 (2.8%) were categorized as low achievers. The findings from the study underscore its robustness, as evidenced by its high validity and reliability. With a p-value of less than 0.005 and utilizing both the Pearson Correlation Coefficient and Cronbach alpha, the study's methodology exhibits strong statistical significance and consistency in its measurements [30]. Interestingly, among the participants, a small percentage, specifically 3 individuals constituting 2.8% of the sample, were classified as high achievers.

This designation suggests a subset of participants who consistently excelled in the parameters measured by the study, showcasing exceptional performance in the context of their educational goals. Conversely, an equivalent number of participants, also 3 individuals or 2.8% of the total sample, were categorized as low achievers. This classification indicates another subset of

Table 3. Artino Model – AMEE Guideline no 87

Step	Purpose
1. Conduct a literature review	To ensure that construct definition align with relevant prior research anf theory and to identify existing survey scale that must be used or adapted
2. Conduct interviews and/or focus group	To learn how population of interest conceptualizes and describes the construct of interest
3. Synthesize interviews and/or focus group	To ensure that the conceptualization of construct makes in accordance with current theoretical sense of scholars in the field and uses language that the population of interest understands
4. Develop items	To ensure items are clear, understandable and written in accordance with current best practices in survey design
5. Conduct expert validation	To assess how clear and relevant the items are with respect to the construct of interest
6. Conduct cognitive interview	To ensure that respondents interpret items in the manner that survey designer intends
7. Conduct pilot testing	To check for adequate item variance, reliability and convergent/discriminant validity with respect to other measures

participants who exhibited comparatively lower performance levels within the study's metrics, suggesting potential areas for support or intervention to enhance their academic outcomes. This in accordance with Mastery learning described by Bloom and his followers [31–34].

Main interesting finding in this study was 2.8% of participants classified as both high and low achievers, almost align with the typical bell curve distribution seen in most populations. In a bell curve distribution, also known as a normal distribution, the majority of individuals tend to cluster around the mean or average, with fewer individuals at the extremes (both high and low ends) of the distribution. The distribution of high and low achievers in this study, each comprising 2.8% of the participants, indicates a relatively small proportion of individuals at the extreme ends of the achievement spectrum, which is almost similar with characteristic of a bell curve distribution. Typically, in educational or academic settings, one would expect to see a bell curve distribution of achievement levels, with the majority of students falling within the average range and smaller percentages of students classified as high achievers (above the mean) or low achievers (below the mean) [35].

An interesting finding was proportion of female versus male students, 66 vs 41 participants respectively. In recent years, a notable trend has emerged within the medical field: the increasing proportion of female medical students and doctors compared to their male counterparts. This shift reflects a significant evolution in societal norms, educational opportunities, and gender equality within the medical profession. Historically, medicine was predominantly viewed as a male-dominated field, with fewer opportunities available for women to pursue careers as physicians. However, as societal attitudes toward gender roles have evolved and educational barriers have been dismantled, more women have been empowered to pursue careers in medicine. One factor contributing to the rise of female medical students and doctors is the increased accessibility of medical education for women.

Over the past few decades, there has been a concerted effort to promote gender diversity within medical schools, leading to greater representation of women in these institutions. As a result, medical institutions and professional organizations have made concerted efforts to recruit and retain female physicians to ensure a more inclusive healthcare workforce. Looking ahead, the trend of increasing female representation in medicine is expected to continue. As more women enter medical school and residency programs, the overall proportion of female doctors is likely to rise. This demographic shift not only reflects greater gender equality within the medical profession but also holds promise for advancing healthcare delivery and improving patient outcomes [36–38].

We found also that 44.86% of participants reported a passion unrelated to medicine, while 5.61% were uncertain of their passions. These passions ranged across a spectrum of interests, from art and literature to sports, music, and culinary pursuits. It was evident that these medical students found joy, fulfillment, and a sense of identity in activities and hobbies that extended far beyond the boundaries of their medical training. Equally noteworthy were the findings concerning uncertainty among the participants regarding their passions. Approximately 5.61% of the medical students expressed uncertainty when asked about their passions, indicating a level of introspection and exploration still underway in their personal journeys.

This uncertainty may stem from various factors, including the evolving nature of personal interests, the pressures of academic and professional demands, or

simply the natural process of self-discovery that accompanies young adulthood. The study shed light on the multifaceted identities of medical students, emphasizing that they are not solely defined by their pursuit of medicine. Instead, they are individuals with diverse interests, talents, and passions that contribute to their holistic development and well-roundedness. These findings have important implications for medical education and student support programs. Recognizing and nurturing the passions and interests of medical students outside of their academic pursuits can contribute to their overall well-being, resilience, and professional fulfillment. Encouraging students to explore and embrace their passions can foster creativity, innovation, and a sense of purpose that enriches their lives both within and outside of medicine. Moreover, these insights underscore the importance of promoting a culture of balance and self-care within medical education. Encouraging medical students to cultivate hobbies, interests, and passions beyond medicine can help mitigate burnout, enhance mental health, and promote overall student satisfaction and success [39–43].

Among the participants surveyed, a significant portion, approximately 28%, acknowledged not being the most influential figure in achieving their educational goals. This finding suggests that many medical students perceive external factors, such as institutional structures, curriculum design, and faculty guidance, as playing a prominent role in shaping their educational experiences and outcomes. While these factors can provide valuable support and resources, they may also pose challenges in maintaining a sense of agency and autonomy in one's academic journey. Furthermore, the study revealed that a notable proportion of medical students, approximately 10.3%, felt that their educational progress was beyond their control.

This sentiment reflects a sense of frustration or disillusionment with the perceived lack of agency or influence in navigating the challenges and opportunities encountered during medical training. Factors such as academic pressure, administrative barriers, and external stressors may contribute to feelings of powerlessness and uncertainty among students. These findings underscore the importance of fostering a supportive and empowering learning environment within medical education. Empowering students to take ownership of their learning and cultivate a sense of agency can enhance motivation, engagement, and resilience in the face of academic challenges. Providing opportunities for student involvement in curriculum development, mentorship programs, and shared decision-making processes can also help to foster a sense of ownership and investment in their educational journey. Moreover, the study highlights the need for institutions and educators to address systemic barriers and promote equity and inclusivity in medical education. Recognizing and mitigating factors that contribute to feelings of disempowerment or lack of control can help to create a more supportive, responsive, and student-centered learning environment [40–43].

Among the participants surveyed, approximately 8.2% cited parental influence as a significant factor in their choice to pursue a career in medicine. This finding underscores the profound impact that parental guidance and expectations can have on shaping the vocational aspirations of young individuals, particularly in highly competitive and prestigious fields such as medicine. Some medical students may experience parental influence in subtle ways, such as receiving encouragement to excel academically or being exposed to healthcare professions from a young age. Others may directly attribute their decision to pursue medicine to the expectations or aspirations of their parents, who may themselves be healthcare professionals or hold strong beliefs about the value of a career in medicine.

While parental influence can serve as a source of motivation and support for aspiring medical students, it also raises important questions about autonomy, self-discovery, and personal fulfillment. The study prompts reflection on the balance between honoring familial expectations and pursuing individual passions and interests in the pursuit of a fulfilling career path. Furthermore, the study highlights the need for aspiring healthcare professionals to critically examine their motivations and values as they embark on their professional journeys. While external influences, such as parental guidance, can provide valuable insights and guidance, it is essential for individuals to ultimately align their career choices with their own aspirations, values, and sense of purpose. The findings of the study underscore the complex interplay of personal, familial, and societal factors in shaping vocational decisions among medical students. By understanding the multifaceted nature of vocational motivations, educators, mentors, and policymakers can better support aspiring healthcare professionals in navigating their career paths with clarity, authenticity, and resilience [44,45].

Among the participants surveyed, only a small fraction, approximately 6.4%, reported having a personal strategy to undertake the educational process and reach their goals. This finding suggests that a significant proportion of medical students may not prioritize or consciously engage in strategic planning and goal-setting as part of their academic approach. This lack of strategic orientation may stem from various factors, including time constraints, perceived complexity of medical education, or a reliance on traditional instructional methods. Furthermore, the study revealed that an additional 6.4% of medical students considered such strategies as unimportant. This

sentiment highlights a potential disconnect between the perceived value of strategic planning and its integration into the academic culture of medical education. Some students may view personal strategies as unnecessary or irrelevant to their learning process, opting instead for more passive approaches to education. These findings underscore the importance of promoting metacognitive skills and self-regulated learning strategies within medical education. Encouraging students to develop and implement personal strategies for goal-setting, time management, and study techniques can enhance academic performance, foster self-efficacy, and promote lifelong learning habits. Moreover, the study highlights the need for educators and institutions to provide support and resources to facilitate the development of effective learning strategies among medical students. Incorporating instruction on study skills, self-assessment, and reflective practice into the curriculum can empower students to take an active role in their learning and academic success [46–48].

Focusing on strategy, this study emphasizes the importance of personal strategies. These high achievers, despite potentially lower self-esteem or educational awareness, may have developed effective methods for navigating the educational landscape. **Redefining high achievers through** this research broadens our understanding of what it means to be a high achiever. It suggests that success can be achieved through various approaches, not just a single mold. Our study suggests t**he importance of self-awareness on** some high achievers may not have high self-esteem, highlighting that self-awareness is still important. Understanding one's strengths and weaknesses can be valuable in any student's educational journey. In addition, **educational system also has crucial role,** the study can prompt reflection on how the educational system can support students with different learning styles and levels of self-awareness. Another explanation is that they are inherently intelligent with high IQ), so their achievement will be good regardless of the teaching methods used by faculties – which rarely mentioned in medical education paper/ textbook [10–17, 46–48].

Overall, these findings contribute valuable insights into the academic dynamics within the study population, highlighting both the presence of high achievers and the challenges faced by individuals categorized as low achievers. By identifying and understanding these distinctions, educators and stakeholders can tailor interventions and support systems to promote academic success and foster an environment conducive to learning and growth for all Our findings suggest that high performers are more than just scores. The differences between high achievers and low achievers among medical students can be multifaceted and may include various factors. First, academic performance: high achievers typically demonstrate consistently high academic performance, reflected in their grades, examination scores, and overall GPA, whereas low achievers may struggle to meet academic expectations and may have lower grades. Second, study habits: high achievers often exhibit effective study habits, such as regular studying, time management, active engagement in learning activities, and seeking help when needed.

In contrast, low achievers may have poor study habits, such as procrastination, lack of organization, and difficulty concentrating. Third, motivation: high achievers are often intrinsically motivated to succeed in their studies, driven by a genuine interest in the subject matter, personal goals, and a desire for academic excellenceClick or tap here to enter text. This study challenges the stereotype of the high achiever. It suggests that academic success isn't solely dependent on high self-esteem or a deep understanding of the educational environment. While these factors can be beneficial, the study reveals that some high achievers excel through a different path. High achievers come in all shapes and sizes **as alternative paths to success**. This study highlights that some may not possess the traditionally associated traits of high self-esteem or in-depth knowledge of the educational system [10–17].

After categorization, the group of low achievers will receive additional special guidance, which is expected to increase their capacity and reduce their weaknesses so that they can achieve the same performance as the high achievers. This includes strengthening motivation, increasing study time through teaching, reinforcing the whole-part-whole model, SQR3, mnemonic utilization, storytelling, gaming, and so on [31–35].

The application of SCL through this questionnaire not only categorizes participants into high and low achievers but also stimulates the capacity of medical faculty students, who are currently learners, to become decision-makers by 2045. This approach aims to shift from a teacher-centered model to a more student-centered one, fostering greater maturity in the participants. The first component of the questionnaire, which focuses on self-understanding, builds reflective capacity, leading to the development of self-directed learners and lifelong learners. The second component involves reviewing the Indonesian Doctor Competency Standards, Educational Guidelines from the Ministry of Education, Collegium, University, Faculty, Study Program, and Learning Contract before the learning process begins. This positions participants as well-informed and consciously incompetent within Noel Burch's quadrant [52]. The third component, understanding the learning mechanism (learning how to learn), encourages participants to be active constructive learners rather than passive followers—simply filling an empty glass or transferring textbook contents to their brains.

Lastly, the component of developing personal strategies to achieve educational goals positions participants as subjects/partners in achieving their educational objectives.

CONCLUSION

This new questionnaire had high validity and reliability in item analysis. More than two percent of participants were classified (predicted) as high achievers and low achievers. There must be refinements in the items and questionnaire presentation, and follow-up activities must be implemented after categorization, especially for the low achievers, to prevent them from becoming retakers.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

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