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Personality and Learning Behavioral Characteristics as Predictors of Academic Achievement of Medical Students

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This study investigates whether personality characteristics and learning behaviors can predict medical students' academic achievement in Korea, specifically in terms of successfully completing medical school without delays or achieving a high grade point average (GPA) in their final year. In May 2018, 316 medical students took the Multi-Dimensional Learning Strategy Test, 2nd edition, which provided data on their personality and learning behavioral characteristics. Their final year's GPA and any delays in completing medical school were ascertained by reviewing all electronic academic records of each semester they had been enrolled. The combination of personality and learning behavioral characteristics was significantly associated with completing medical school without delays, even after adjusting for sex and admission path. A multiple logistic regression analysis showed that the adjusted odds ratios and 95% confidence intervals for completing medical school without delays were 1.52 (95% confidence interval [CI], 0.83–2.78) and 3.64 (95% CI, 1.70–7.82) for "others" and "both high" categories, respectively, when compared with the "both low" category. For 235 students who completed medical school without delays, their learning behavioral characteristics (scores) were significantly associated with their final year's GPA even after adjusting for sex, admission path, and personality characteristics (scores) as determined by the multiple linear regression analysis. This study suggests that individual personality and learning behavior characteristics are predictors of medical students' academic achievement. Therefore, interventions such as personalized counseling programs should be provided in consideration of such student characteristics.

Keywords: Academic success; Republic of Korea; Test taking skills

Introduction

Almost all Korean medical schools require students to repeat the same year if they fail in even one subject or their grade point average (GPA) is below a certain level. Regulations are strictly enforced, such as the student's being suspended when they get an F in a course.

In a study of first- and second-year medical students, 17% of students reported that they had already experienced grade repetition [1]. It is a great loss to individuals, the nation, and society when a significant number of outstanding students fail to succeed in the intense competition of medical schools [2].

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In medical school, assigning an F grade, which indicates grade retention, signifies that neither the school nor the professor assumes responsibility for the student's failure to meet the learning objectives in that subject and instead places the responsibility solely on that student.

The Accreditation Standards of the Korean Institute of Medical Education and Evaluation 2019 (ASK2019) require medical schools to analyze problems with grade retention and prepare measures to guide students who show poor academic achievement [3].

To provide interventions for underachievers, it is necessary to identify the predictors of academic achievement, such as the learner's personality and learning behavioral characteristics including learning strategies [4-7]. They were associated with self-assessed academic performance in medical students [4], and with GPA in health science students in Korea [5]. Another study also revealed that self-regulating learning strategies could predict the GPA of medical students in Iran [6].

This study aims to determine whether personality and learning behavioral characteristics are predictors of successful academic achievement among medical students in Korea, specifically the goals of completing

medical school without delays and achieving a high GPA in the final year.

Methods

1. Setting, participants, and study design

Gyeongsang National University College of Medicine has collected data (Gyeongsang Medical College Cohort data) on the demographics and academic achievements of all students admitted since 2010 from the university's computerized information system for medical program evaluation and administrative purposes from 2022.

The Gyeongsang Medical College Cohort provided data of student identification number, sex, admission path, and final school year GPA. Delays in completing medical school were ascertained by reviewing the electronic academic records of each semester enrolled.

This is an observational, retrospective cohort design with a dependent variable of GPA of the final school year. It is a cross-sectional study of delays in completing medical school as a dependent variable because a significant proportion of delays occur before taking the MLST-II test. Figure 1 shows the period during which the delay occurred for the 81 of 316 students who repeated any school year and the final school year of the 235 students who entered their fourth year without delay.

The Institutional Review Board of Gyeongsang National University Hospital approved this study (GNUH-IRB 2023-06-016).

2. Variables and measurement tool

Independent variables were student sex, admission path (admission to medical school, transfer to medical school, or admission to a premedical department), personality, and learning behavioral characteristics. The medical students' academic achievement was measured by two outcome variables: delays including grade retention or leave of absence in completing medical school and GPA of the final school year.

Personality and learning characteristics were measured with the Multi-Dimensional Learning Strategy Test, 2nd edition (MLST-II) (Inpsyt, Seoul, Korea). Personality characteristics included subscales of academic self-efficacy, outcome expectation, and conscientiousness. High scores indicated initiative in studying [7]. Learning characteristics included the subscales of time management, listening, note taking, learning environment, concentration, book reading, memory skills, and examination preparation. High scores indicated overall good learning skills [7]. The score of each subscale was expressed as a T-score (average = 50, standard deviation = 10) from a standardized test.

All the 316 medical students (83 first-year, 76 second-year, 83 third-year, and 74 fourth-year students) in 2018 took the MLST-II in May after providing informed consent. The test was developed in Korean and aimed to understand the effectiveness of a student's learning strategy, identify factors that affect learning, and provide suggestions for necessary intervention [7].

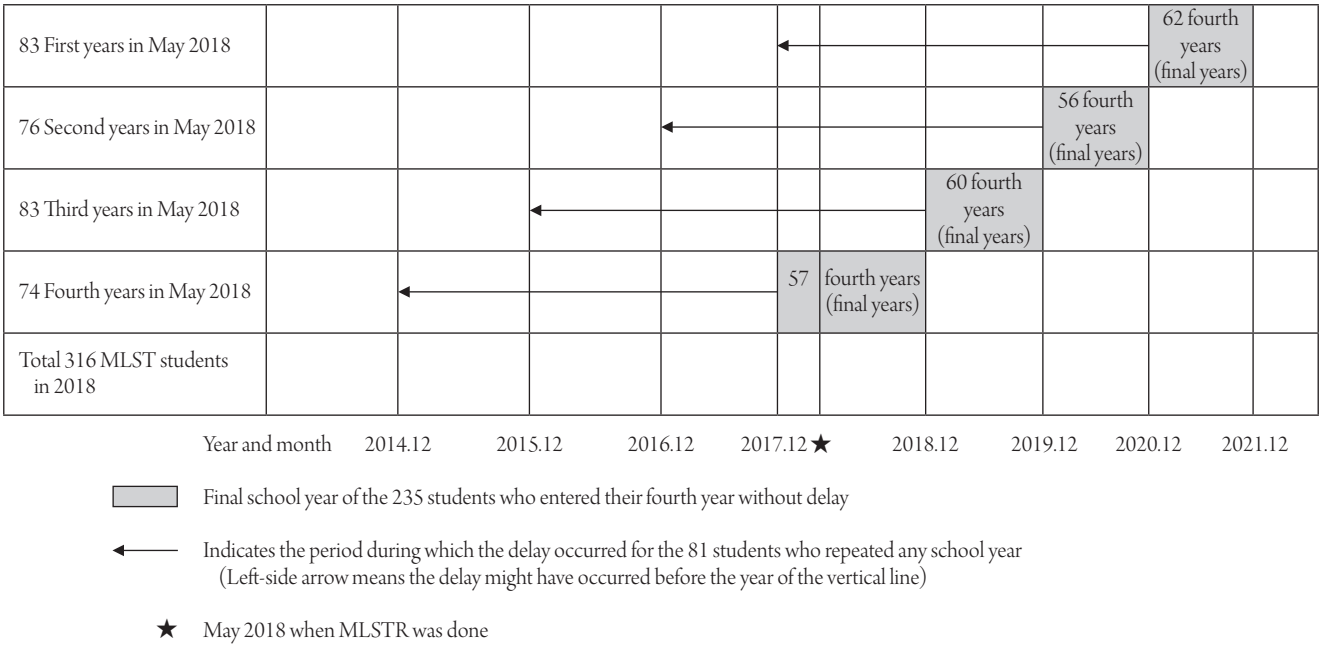

Figure 1. The period during which the delay occurred for the 81 of 316 students who repeated any school year and the final school year of the 235 students who entered their fourth year without delay. MLST, Multi-Dimensional Learning Strategy Test.

After combining MLST-II test results with the Gyeongsang Medical College Cohort data, the dataset was anonymized.

3. Statistical methods

In a simple analysis, we created cross-tabulations to compare sex, grade, admission path, personality, and learning characteristics depending on delays in completing medical school. The scores of the personality and learning characteristics were categorized into quintiles.

We combined personality and learning behavioral characteristics, each with five categories, to create a new variable with three categories of both low (1 or 2) quintiles, others, and both high (4 or 5) quintiles. p-values were calculated using the χ^2 or χ^2 for a trend test. The adjusted odds ratio (OR) and 95% confidence interval (CI) of personality and learning behavioral characteristics for completing medical school without delays were also calculated using multiple logistic regression analysis. In this regression model, we included the new combined variable instead of both personality and learning behavioral characteristics as independent variables because of multicollinearity.

For the 235 students completing medical school without delays, we analyzed the associations of sex, admission path, personality, and learning behavioral characteristics with final-year GPA by analysis of variance, or Pearson's correlation analysis. Adjusted regression coefficients of personality and learning behavioral characteristics for GPA of the final school year were calculated using multiple linear regression analysis. Grade was excluded from the models due to its close relationship with the admission path.

All analyses were performed using IBM SPSS Statistics ver. 25.0 (2017; IBM Corp., Armonk, NY, USA).

Results

1. Participants

This study included all 316 current medical students (83 first-year, 76 second-year, 83 third-year, and 74 fourth-year students) in 2018. Of the study subjects, 62.0% were male and 38.0% were female. Regarding admission path, 53.8% were admitted to medical school, 14.2% were transferred to medical school, and 32.0% were admitted to a premedical department (Table 1). All 157 third- and fourth-grade students were admitted to the medical school.

2. Characteristics of the study students depending on delays in completing medical school

Of the 316 students studied, 74.4% successfully completed medical school without any delays. Significantly higher percentages of females (84.3%) than males (68.2%) completed medical school without delays. Admission path was not significantly associated with completing medical school without delays. The proportions of students completing medical school without delays varied between 68.8% and 81.2%. Grade was not significantly associated with completing medical school without delays. The proportions varied between 72.3% and 77.0%. Quintiles of personality and learning behavioral characteristics were significantly and linearly associated with completing medical school without delays. The same was true for the combination of two variables. The proportions in both low categories, others, and both high ones were 65.9%, 72.0%, and 86.0%, respectively (Table 1).

3. Adjusted odds ratios and 95% confidence intervals for completing medical school without delays by characteristics of the study students

The combination of personality and learning behavioral characteristics was significantly associated with completing medical school without delays even after adjusting for sex and admission path in the multiple logistic regression analysis. The adjusted ORs for completing medical school without delays of female students compared with male students was 2.54 (95% CI, 1.39–4.63). The adjusted ORs for completing medical school without delays of "transfer to medical school" and "admission to premedical department" compared with "admission to medical school" were 1.51 (95% CI, 0.66–3.48) and 2.55 (95% CI, 1.35–4.79), respectively. The adjusted ORs for completing medical school without delays of "others" and "both high" compared with "both low" were 1.52 (95% CI, 0.83–2.78) and 3.64 (95% CI, 1.70–7.82), respectively (Table 2).

4. Correlation of personality, learning behavioral, and other characteristics with GPA of the final school year in students completing medical school without delays

For 235 students completing medical school without delays, Pearson's correlation coefficient between personality and learning behavioral characteristics was 0.76. Pearson's correlation coefficients of GPA of the final school year with personality and learning behavioral characteristics were 0.21 and 0.25, respectively. All met the significance threshold at 0.01 (Table not shown).

The GPA of the final school year was 3.51 for female students and 3.18 for male students, which was significantly different. It was not significantly different by admission path (Table 3).

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Table 1. Characteristics of the study students completing medical school without delays

Characteristic	Total	Completing medical school without delays	χ^2 (χ^2 for trend)
Sex			10.14**
Male	195 (62.0)	133 (68.2)	
Female	121 (38.0)	102 (84.3)	
Admission path			5.961
Admission to medical school	170 (53.8)	117 (68.8)	
Transfer to medical school	45 (14.2)	36 (80.0)	
Admission to premedical department	101 (32.0)	82 (81.2)	
Grade			0.49 (0.050)
1st year	83 (26.3)	62 (74.7)	
2nd year	76 (24.1)	56 (73.7)	
3rd year	83 (28.4)	60 (72.3)	
4th year	74 (21.0)	57 (77.0)	
Personality characteristics			14.45** (12.42***)
1st quintile	61 (19.3)	39 (63.9)	
2nd quintile	61 (19.3)	39 (63.9)	
3rd quintile	68 (21.5)	50 (73.5)	
4th quintile	58 (18.4)	50 (86.2)	
5th quintile	68 (21.5)	57 (83.8)	
Learning behavioral characteristics			10.44* (6.34*)
1st quintile	61 (19.3)	36 (59.0)	
2nd quintile	65 (20.6)	51 (78.5)	
3rd quintile	64 (20.3)	48 (75.0)	
4th quintile	63 (19.9)	48 (76.2)	
5th quintile	63 (19.9)	52 (82.5)	
Combination of personality and learning behavioral characteristics			10.42** (9.74**)
Both low (quintile 1 or 2)	91 (28.8)	60 (65.9)	
Others	132 (41.8)	95 (72.0)	
Both high (quintile 4 or 5)	93 (29.4)	80 (86.0)	
Total	316 (100.0)	235 (74.4)	

Values are presented as number (%).
*p<0.05. **p<0.01. ***p<0.001.

Table 2. Adjusted odds ratios and 95% CIs for completing medical school without delays by characteristics of the study students from the logistic regression analysis

Variable	Odds ratio (95% CI)
Sex	
Male	1
Female	2.54 (1.39–4.63)
Admission path	
Admission to medical school	1
Transfer to medical school	1.51 (0.66–3.48)
Admission to premedical department	2.55 (1.35–4.78)
Combination of personality and learning behavioral characteristics	
Both low (quintile 1 or 2)	1
Others	1.52 (0.83–2.78)
Both high (quintile 4 or 5)	3.64 (1.70–7.82)
Hosmer and Lemeshow test	
χ^2	6.01
p-value	0.65

CI, confidence interval.

Table 3. GPA of the final school year in students completing medical school without delays by characteristics of study students (n=235)

Variable	Total no. (%)	GPA (mean±SD)	F-value
Sex			56.62***
Male	133 (56.6)	3.18±0.37	
Female	102 (43.4)	3.51±0.36	
Admission path			0.57
Admission to medical school	117 (49.8)	3.34±0.38	
Transfer to medical school	36 (15.3)	3.34±0.38	
Admission to premedical department	82 (34.9)	3.28±0.43	
Total	235 (100.0)	3.32±0.40	

Values are presented as number (%) or mean±SD.
GPA, grade point average; SD, standard deviation.
***p<0.001.

5. Adjusted regression coefficients for GPA of the final school year by characteristics of the study students among students completing medical school without delays

Learning behavioral characteristics (scores) were significantly associated with the GPA of the final school year even after adjusting for sex, admission path, and personality characteristics (scores) in the multiple linear regression analysis. The adjusted regression coefficients for the GPA of the final school year and personality and learning behavioral characteristics were 0.00 ($p > 0.05$) and 0.01 ($p < 0.05$), respectively. The effect of learning behavioral characteristics was the second largest ($\beta = 0.18$) after sex. The adjusted R^2 was 0.22 (Table 4).

Discussion

In this study, learning behavioral characteristics measured with the MLST-II test significantly predicted medical students' academic achievements, as assessed by their GPA of the final school year. High scores of learning behavioral characteristics, when combined with high scores of personality characteristics, increased the adjusted odds of completing medical school without delays by 3.6 times. It also significantly predicted the GPA of the final school year after adjusting for sex, admission path, and personality characteristics. The effect was second largest after sex.

Completing medical school without delays needed both the high scores of personality and learning behavioral characteristics, whereas GPA of the final school year only need the high scores of learning behavioral characteristics. Students who experienced delays had an average GPA of 2.85, which was significantly lower than 3.32 for students who did not experience delays (data not shown). Predictors of GPA were analyzed only for the students completing medical school without delays in this study. Regarding delays in completing medical school, the failure experiences were due to both personal and structural factors such as a competitive culture, restrictive professor-student relationships, and indifference toward students' quality of life [2]. In contrast, a high GPA needed mainly personal effort. Completing medical school without delays and achieving a high GPA for the final school year may have different predictors.

Personality characteristics measured with the MLST-II test include subscales of academic self-efficacy, outcome expectation, and conscientiousness, which collectively represent the ability to take the initiative in studying. The subscales of academic self-efficacy and outcome expectation were developed based on social cognitive theory [7]. A study using a social cognitive framework suggested that self-efficacy and outcome expectation together predict an interest in education [8].

Personality characteristics or academic self-efficacy alone measured with the MLST-II test affected academic achievement in previous studies among Korean college students [4,5,9].

Low confidence in one's own abilities will not motivate continuous effort for the desired goal. As a result, the possibility of achieving the desired goal will be low [7]. Using other measurement tools in other countries, studies found that personality traits including conscientiousness directly and indirectly contributed to the medical students' academic performance through self-efficacy [10]. However, outcome ex-

Table 4. Adjusted regression coefficients for GPA of the final school year by characteristics of the study students among students completing medical school without delays from the multiple linear regression analysis (n=235)

Variable	GPA of the final school year			
	B	Standard error	β	t-value
Constants	2.45	0.17		14.73***
Sex				
Male	0			
Female	0.34	0.05	0.43	7.23***
Admission path				
Admission to medical school	0			
Transfer to medical school	-0.10	0.07	-0.09	-1.49
Admission to premedical department	-0.02	0.05	-0.02	-0.31
Personality characteristics (scores)	0.00	0.00	0.10	1.12
Learning behavioral characteristics (scores)	0.01	0.00	0.18	2.00*
Adjusted R^2	0.22			
F-value	14.32***			

GPA, grade point average.
*p<0.05. ***p<0.001.

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pectation was not a significant component in predicting students' academic achievement [6].

In the MLST-II test used in this study, learning behavioral characteristics, including learning strategies, were composed of the most common and representative learning skills including resource management strategies classified by various studies [7]. They involved subscales of time management, listening, note taking, learning environment, concentration, book reading, memory skills, and examination preparation.

Learning behavioral characteristics or time management alone measured with the MLST-II test affected academic achievements in previous studies of Korean college students [4,5,9].

Learning strategies including cognitive, metacognitive, and resource management strategies are predictors of students' academic achievement [6]. A literature review concluded that learning skills or strategies were fundamental to academic competence and could be taught [11].

On the interrelationships between personality, learning behavioral characteristics, and academic achievements, a study using the MLST-II test suggested personality characteristics directly and indirectly affected academic achievements via learning behaviors in the path model [4].

In this study, we used dependent variables of the GPA of the final school year and delays (grade retention or leave of absence) in completing medical school. MLST-II test results were temporally higher in all study subjects with regard to the GPA of the final school year. However, for the delay in completing medical school, the temporal relationships might be uncertain. For some students, grade retention or leave of absence occurred before taking MLST-II test, which might alter their behavioral characteristics. On the contrary, progression to the next year without repetition could increase self-efficacy for some students. Because this study was performed with students in one medical college in one year, there may be limitations for generalizability.

Because learning behaviors composed of learning skills are modifiable [11], interventions aimed at correcting them can improve the academic achievements of medical students. To confirm this, we need a randomized controlled trial in future study.

Medical students must learn an enormous amount of information. Learning difficulties among medical students present not only individual academic problems, but also a challenge to current medical education programs. It is necessary to take measures at the school level and not leave the challenge up to the individual students.

This study suggests that individual personality and learning behavior characteristics are predictive factors for medical students' academic achievement. Therefore, interventions such as personalized counseling programs should be provided in consideration of these student characteristics.

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Conflict of interest

No potential conflict of interest relevant to this article was reported.

Authors' contribution

Conceptualization: JRK, JRH; methodology: JRK, MJK; data collection: JRH; data curation: MJK; formal analysis: JRK; writing-original draft: JRK; writing-review & editing: YAJ, MJK; project administration: JRH; and final approval of the version to be published: all authors.

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