Conscientiousness and Neuroticism Predicted Learning Approaches of Medical Students

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ABSTRACT

There are minimal published data on the relationship between personality traits and learning approaches among medical students. This study explored the causal-effect relationship of personality traits and learning approaches among medical students. A cross-sectional study was conducted on medical students and they responded to the Learning Approach Inventory and USM Personality Inventory to measure personality traits and learning approaches, respectively. A structural equation modelling was performed by AMOS 24 to test the causal-effect relationship of personality traits and learning approaches. Conscientiousness had a positive direct effect on deep learning approach, while neuroticism had negative direct effect on deep and strategic learning approaches. Extraversion, openness, and agreeableness had no significant link or effect on any learning approaches. Strategic learning approach had positive direct effect on deep learning approach and a mediator for surface learners on deep learning approach. Surface learning approach had a negative direct effect on deep learning approach. There was a significant relationship of specific personality traits and learning approaches. Conscientiousness and neuroticism had significant relationships with deep and strategic learning approaches. These findings enables medical educators to have a better understanding of the influence of personality traits on medical students' learning approaches to learning tasks and their implications on instructional strategies.

Keywords: *Deep learning approach, Surface learning approach, Strategic learning approach, Big-Five personality traits, Medical students*

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INTRODUCTION

Personality trait is the combination of an individual's behaviour, emotion, motivation and characteristics of their thought patterns (1). Our personality traits have a great impact on our lives, affecting our life choices, well-being, career preferences and desires, and academic success (1–7). The five-factor model (i.e., the Big-Five personality) is one of the most prominent and heuristic models of personality structure and the Big-Five personality traits model accounts for a large amount of variability in personality (8). The Big-Five personality traits have become a scientifically useful

structure in personality traits research (7). Extraversion refers to characteristics such as energetic, excitability, enjoy being with people, talkativeness, enthusiasm, assertiveness and high amount of emotional expressiveness (9–11). Conscientiousness refers to features such as high levels of thoughtfulness, with good impulse control and goal-directed behaviour, and being organised and detail-oriented (9–11). Agreeableness is commonly characterised by trustworthiness, sympathy, cooperativeness, generosity, helpfulness and kindness (9–11). Neuroticism is commonly linked with features such as emotional instability, distress, depression, anxiety, moodiness, irritability, poor coping ability and sadness (9–11). Openness is reflected in individuals with qualities such as creativity, artistic, broad range of interest, imaginative, insightful and down-to-earth (9–11). One of the major factors related to student characteristics, according to Biggs, is students' personality (8, 12). Students' study process is examined in terms of their approaches (learning approaches) to their learning tasks (8).

The concept of learning approaches adopted by students was well established in higher education around the year 1970 (14). Three common learning approaches are conceptualised in the literature – surface, strategic and deep learning approaches (6, 12). The existing different characteristics of these three approaches are determined by the learners' motive (i.e., intention) and strategy (i.e., process) when learning (12–13). Deep learners usually learn by understanding the subjects based on evidence, with the purpose of seeking their own meaning of the subjects, enhancing their understanding and producing mastery (6, 12–14). Strategic learners normally learn through smart and organised study, where they are bound to the syllabus of the course and their goal is to acquire the highest possible marks (6, 12–14). Surface learners commonly learn through memorising facts, learning out of fear of failing and focusing on putting the minimum effort to pass the examination (6, 12–14). Previous evidence

relating to learning approaches to academic performance is inconsistent (15–16). One study found that strategic (achieving) learning predicted exam success (17) and another study found that deep learning was positively related to grade point average (GPA) (in Sociology) (18) and psychological health (in Medicine) (6), while surface motive was negatively related to exam results (in Nursing programmes) (18). On the other hand, Duff (19) found that surface and deep learning correlated negatively with assignment grades, while strategic approach correlated positively. In the prediction model proposed by a previous study based on a sample of university students (8), conscientiousness and openness traits contributed the most in accounting for the differences in students' learning approaches. The study by Zhang (8) concluded that:

a. Conscientiousness was a good predictor for both the deep and the strategic approaches.

b. Openness significantly predicted the deep approach to learning.

c. Neuroticism was a good predictor for the surface approach to learning.

d. Agreeableness trait negatively predicted a deep and strategic learning approach.

e. No distinct pattern was identified regarding the relationship of extraversion to any of the learning approaches.

Despite these results, the role of the Big-Five personality traits in medical student learning has not been given the attention that it deserves (20–21). Given this fact, there is a need to explore the causal-effect relationship of personality traits with learning approaches in a medical education context involving undergraduate medical students. Establishing this relationship will enable medical educators to have a better understanding of the influence of personality traits on medical students' learning approaches to learning tasks and their preference of instructional strategies

(16, 22–23). In fact, understanding this relationship will help medical schools to develop and design medical curriculum that personalise to their students' learning preferences.

The present study was set out to explore the relationships of Big-Five personality traits with different learning approaches. In line with the above-reviewed literature, it was predicted that the Big-Five personality traits would correlate significantly with learning approaches. Furthermore, it was also hypothesised that conscientiousness would be linked with deep learning and strategic learning, whilst openness would be linked with strategic learning approach and neuroticism with surface learning.

MATERIALS AND METHODS

This study employed a cross-sectional design and was conducted at a medical school; the estimated sample size was 278 students. Universal sampling was used, in which all second-year (preclinical) and fifth-year (clinical) students were invited to participate in this study. The main reason for selecting second- and fifth-year medical students was because both cohorts were at the final phase of their preclinical and clinical training, thus they were considered to represent the entire look of the medical programme. Prior to the study, the ethical clearance was obtained from the institutional ethics committee (USM/JePEM/16090274). Informed consent was acquired from all participants before data collection. They were informed that participation in this study was entirely voluntary and confidentiality would be maintained throughout this study. They were then requested to fill in two validated questionnaires: the 9-item Learning Approach Inventory (LA-9) and the 15-item USM Personality Inventory (USMaP-15).

The main reason for using LA-9 and USMaP-15 was because they have been well validated in the local medical student population.

LA-9 is used to identify the learning approach among medical students in the Malaysian context (24–26). It consists of nine items with three domains that are surface, strategic and deep learning approaches. The LA-9 items are rated using 5-point Likert scores to show how close the statement described the respondents' behaviour. The highest domain score determines the learning preferences of the respondent. It has been reported as a valid and reliable instrument with the overall Cronbach's alpha of 0.86 (24–26).

USMaP-15 measured the Big-Five personality traits which are extraversion, conscientiousness, agreeableness, neuroticism, and openness (11, 27–29). It has been used by the local medical schools to identify personality traits among medical students and applicants (11, 27–29). It consists of 15 items representing the five different personality traits and uses the 5-point Likert scores for rating the items. It has been reported as a valid and reliable tool to determine the personality traits of medical students in the local setting (11, 28–30). Its Cronbach's alpha ranged between 0.59 and 0.73 (11, 27–29).

A descriptive analysis of the demographic data was performed using the Statistical Package for Social Sciences (SPSS) version 26. Structural equation modelling (SEM) was performed to examine the interrelations between observable variables in the proposed model (Figure 1). SEM were performed using the Analysis of Moment Structure (AMOS) software version 24. The final model will be considered fit if all the goodness of fit indices achieved the minimal requirement (31), as shown in Table 1.
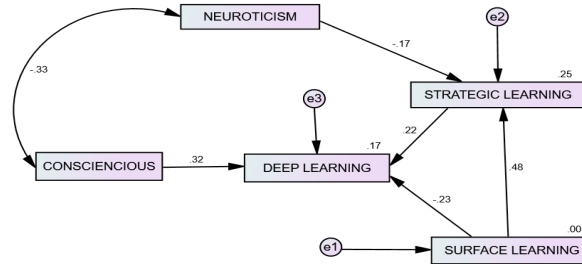
Figure 1: SEM (standardised estimates) of the relationships of personality traits with learning approaches.

Table 1: Goodness of fit indices used to signify model fitness

Name of category	Name of index	Level of acceptance
Absolute fit[a]	Root mean square of error approximation (RMSEA)	Less than 0.08
	Goodness of fit index (GFI)	More than 0.9
Incremental fit[b]	Comparative fit index (CFI)	More than 0.9
	Tucker-Lewis index (TLI)	More than 0.9
	Normed fit index (NFI)	More than 0.9
Parsimonious fit[c]	Chi square/degree of freedom (Chisq/df)	Less than 5

Notes: [a]Absolute fit: Measures overall goodness of fit for both the structural and measurement models collectively. This type of measure does not make any comparison to a specified null model (incremental fit measure) or adjust for the number of parameters in the estimated model (parsimonious fit measure). [b]Incremental fit: Measures goodness of fit that compares the current model to a specified "null" (independence) model to determine the degree of improvement over the null model. [c]Parsimonious fit: Measures goodness of fit representing the degree of model fit per estimated coefficient. This measure attempts to correct any "overfitting" of the model and evaluates the parsimony of the model compared to the goodness of fit.

RESULTS

Out of 278 medical students, 219 students responded completely to the two inventories. A total of 103 (47%) were the preclinical students and 116 (53%) were the clinical students. The majority of respondents were female (n = 131) and Malay (n = 119).

The goodness of fit indices for the relationship of Big-Five personality traits and learning approaches among medical students are summarised in Table 2 and illustrated in Figure 1. The standardised regression coefficients between variables are summarised in Table 3. The direct, indirect and total effects of the model paths are shown in Table 4.

Table 2: The goodness of fit indices for supporting the best fit model

Model	χ^2 statistics (*df*)	*p*-value	Goodness of fit indices					
			χ^2/df	RMSEA	GFI	CFI	NFI	TLI
Final model	7.237 (4)	0.124	1.809	0.061	0.987	0.975	0.947	0.937

Notes: χ^2/df: Chi square/degree of freedom; RMSEA: Root mean square of error approximation; GFI: Goodness of fit index; CFI: Comparative fit index; NFI: Normed fit index; TLI: Tucker–Lewis index.

Table 3: The estimates of standardised and unstandardised regression weights of personality traits and learning approaches

Independent variables	Dependent variables	β	B	SE	*p*-values
Conscientiousness	Deep learning	0.322	0.293	0.056	<0.001
Strategic learning		0.220	0.208	0.067	0.002
Surface learning		−0.233	−0.193	0.058	<0.001
Neuroticism	Strategic learning	−0.166	−0.152	0.053	0.004
Surface learning		0.476	0.417	0.051	<0.001

Notes: β = Standardised regression weights; B = Unstandardised regression weights; SE = Standard error; Extraversion, openness, and agreeableness were excluded by the analysis from the model due to the failure to reach any significant relationship with the learning approaches.

Conscientiousness and strategic learning approach significantly increased deep learning approach, while surface learning significantly decreased deep learning approach (Table 3, Figure 1). Therefore, medical students with high conscientiousness and strategic learning approach are more inclined to use the deep learning strategy. Neuroticism trait significantly decreased strategic learning approach, while surface learning significantly increased strategic learning approach (Table 3, Figure 1). Thus, medical students with high neuroticism are less likely to use strategic learning approaches. This analysis also reveals that medical students who use the surface learning strategy are more likely to use the strategic learning approach than those who use the deep learning approach.

Table 4 shows that conscientiousness, strategic learning approach and surface learning approach have significant direct effects on deep learning approach. These results indicate that medical students who have high conscientiousness and learning strategically are more likely to utilise deep learning approach. In other words, conscientiousness and strategic learning approach are positive predictors of deep learning approach. Conversely, surface learning approach significantly reduced the tendency of medical students to learn through deep learning approach, indicating that it is a negative factor for deep learning.

Table 4 shows that neuroticism and surface learning approach have a significant direct effect on strategic learning approach. Neuroticism demonstrates a significant negative direct effect on strategic learning approach and a significant negative indirect effect on deep learning approach. These results indicate that neuroticism is a negative factor for both learning approaches among medical students. Interestingly, surface learning approach showed a positive indirect effect (mediated by strategic learning approach) on deep learning approach. This result indicates that strategic learning approach is a mediator for surface learners to utilise deep learning approach. Additionally, these results showed that strategic learning approach is a significant mediator for neuroticism and surface learning approach on deep learning.

These findings demonstrated that deep learning approach was significantly increased by conscientiousness and strategic learning, indicating that both were positive predictors of deep learning approach. This suggests that both factors encourage medical students to utilise deep learning approach to learning tasks. Surface learning, on the other hand, considerably lowered the deep learning strategy, demonstrating that it is a negative element of the deep learning technique. This indicates that surface learners are less likely to utilise deep learning approach to learning tasks. Neuroticism shows a consistently negative

Table 4: The unstandardised and standardised estimates of direct, indirect and total effects of personality traits and learning approaches

Parameter	Independent variable	Dependent variable	Total	Direct	Indirect
Unstandardised	Conscientiousness	Deep learning	0.293**	0.293**	–
	Neuroticism		–0.032**	–	–0.032**
	Strategic learning		0.208**	0.208**	–
	Surface learning		–0.106	–0.193**	0.087**
	Neuroticism	Strategic learning	–0.152**	–0.152**	–
	Surface learning		0.417**	0.417**	–
Standardised	Conscientiousness	Deep learning	0.322**	0.322**	–
	Neuroticism		–0.037**	–	–0.037**
	Strategic learning		0.220**	0.220**	–
	Surface learning		–0.128	–0.233**	0.105**
	Neuroticism	Strategic learning	–0.166**	–0.166**	–
	Surface learning		0.476**	0.476**	–

Notes: Bootstrap (1,000) with 95% bias-corrected confidence interval; L = lower bound; U = upper bound; **p-value < 0.01; *p-value < 0.05.

effect on deep and strategic learning approaches, indicating that both factors discourage medical students from utilising deep learning and strategic learning approaches to learning tasks. Conscientiousness and strategic learning approach significantly promote deep learning, while neuroticism and surface learning prevent medical students from using deep learning; however, surface learning was positively affected by strategic learning approach, leading to deep learning approach. These results indicate that personality traits have significant effects on learning approaches. Nevertheless, extraversion, openness, and agreeableness were excluded from the final model as they have no significant effect on any learning approaches.

DISCUSSION

This study contributes several important findings to the current body of knowledge. First, medical students who exhibit conscientiousness tend to utilise deep learning approach to learning tasks. Second, medical students who exhibit neuroticism exhibit low tendency to utilise deep and strategic learning approaches. Third, no distinct pattern was identified regarding the relationship of extraversion, openness, and agreeableness extraversion to any of the learning approaches. Fourth, strategic learning approach promotes deep learning approach and is even a mediator for surface learners to utilise deep learning approach. Lastly, medical students who utilise the surface learning approach are less likely to change their learning approach to deep learning.

Medical students who are high in conscientiousness tend to utilise deep learning approach to learning tasks. Similar finding was reported by previous studies (8, 22) that found conscientiousness is an excellent predictor for the deep learning approaches. Conversely, another study reported that conscientiousness had no significant relation with deep learning approach (15). The different findings might be due to the different measurement tools measuring the Big-Five personality traits. Nevertheless, one possible explanation for the significant effect of conscientiousness on deep learning is that students with high

conscientiousness are characterised as being purposeful, strong-willed, responsible and trustworthy, and therefore tend to learn through understanding, where their intention is to seek their own meaning to enhance their understanding and mastery of subjects (10, 12, 32). It is very obvious that if many of our medical students are predominantly conscientiousness, the instructional strategies of medical curriculum should allow them to seek their own meaning to facilitate the mastery of the subjects learnt. Hence, the learning activities should be designed through active, engaging and collaborative learning such as cognitive load-based interative lectures (33), team-based learning (34–35), and problem-based learning (36).

Medical students high in neuroticism exhibit low tendency to utilise deep and strategic learning approaches to learning tasks. Several studies (8, 22, 37) found that neuroticism had no link with deep and strategic learning approach, but was reported as a good predictor for the surface learning approach (15). Importantly, individuals who are predominantly neuroticism tend to experience negative feelings, pessimism, and low self-esteem (9–11), hence these characteristics are the opposite to the characteristics of deep and strategic learning approach that are active, making meaning and being optimist in the process of learning (12–13, 32). Furthermore, individuals with neuroticism are vulnerable to experience intense feelings due to the demand of medical training (38) and well-established negative factors contributing to academic success (39) and satisfaction (5). Since neuroticism has unfavourable influence on the learning approach to learning task and is succesptible to unfavourable stress, providing positive learning environment is essential to facilitate their learning. One study reported that positive learning environment reduce the psychological pressure of medical students during medical training (6). One important lesson is to implement engaging and non-threatening instructional strategies that

promote teamwork and strengthen social connectedness. Two useful instructional strategies that can be used to promote students' engagement during learning are inquiry-based learning and simulation-based learning (40). In inquiry-based learning, students are presented with relatively open, ill-structured and authentic scenarios that they are asked to investigate, analyse and resolve, for example problem-based learning. In the simulation-based learning, learners are presented with conceptual simulation, procedural simulation or role-play simulation tasks (40). Conceptual simulation tasks ask students to manipulate the parameters of a real-world phenomenon to see its impact, procedural simulation tasks ask students to complete activities that require them to develop their knowledge and understanding of a sequence of steps in a task, and role-play simulation tasks ask students to take up different roles in a scenario that can be completely fabricated or based on authentic, real-world cases and events in order for them to gain different perspectives on a given situation (40). This effort will optimise learning approaches to learning tasks of the learners who are predominantly neuroticism.

No distinct pattern was identified regarding the relationship of extraversion, openness and agreeableness extraversion to any of the learning approaches. These facts suggest that these three personality traits have no influence on medical students' tendency to any of the learning approaches. One study conducted on undergraduate students in a non-medical programme reported that extraversion and openness demonstrated a weak positive correlation with deep learning approaches, while none of the Big-Five personality traits showed significant correlation with surface learning approach (5). In other studies, openness significantly predicted the deep approach to learning (8, 22) and a study revealed that only openness was positively linked with deep learning approach and negatively linked with surface learning approach (23). The inconsistent observation might be due to different tools

used to measure the personality traits. The study findings support the view of other researchers that the Big-Five personality will only have certain degree of impact on the students' learning approaches (8, 22). One important lesson is that these three personality traits have non-significant influence on learning approaches of medical students to learning tasks, thus have less implication on instructional strategies at the final phase of preclinical and clinical phase as reflected in this study sample, the second- and fifth-year medical students.

Strategic learning approach promotes deep learning approach and is even a mediator for surface learners to utilise deep learning approach. These findings indicate that medical students with strategic learning approach will have the tendency to adapt deep learning approach, and it has a mediating role to facilitate surface learners to become deep learners. Strategic learners generally learn through systematic and smart study, where their intention is to attain the highest marks possible (6, 12–14). Therefore, it is not surprising that significant positive relationship with deep learning approach is observed. Interestingly, promoting strategic learning approach will facilitate surface learners to adapt deep learning approach. An important message from this finding is that educators should employ active, collaborative and engaging instructional strategies that promote strategic learning strategies in order to encourage surface learners to become deep learners.

Finally, medical students who utilise the surface learning approach are less likely to change their learning approach to deep learning. This finding indicates that medical students with surface learning approach have less tendency to adapt deep learning approach. This finding is sensible because the characteristics of deep and surface are totally opposite (6, 12–14), but one study reported that surface learning had no correlation with deep learning (15). Despite the discrepancy from the previous finding, this study provides evidence to support

the causal-effect relation between both the surface and deep learning approaches. One implication of this finding is that educators should avoid employing didactic instructional strategies that promote surface learning approach among learners.

Several limitations are worth to be noted. The sample was limited to medical students in a medical school, therefore any attempt to generalise this result should be made within its context. Only second- and fifth-year medical students were included in this study, therefore it may not accurately represent the overall pattern of personality traits and learning approaches among medical students. A multi-centre study is therefore recommended to be conducted to verify the current finding. Perhaps, expanding this research to the the workplace-based performance will provide a better understanding of how personality factors and learning approaches affect clinical success. Another limitation is that the current study used different instruments (i.e., LA-9 and USMaP-15) in measuring learning approaches and personality traits, whereas most of the Western researchers used NEO-Five-Factor Inventory, Study Process Questionnaire (SPQ), and the Approaches and Study Skills Inventory for Students (ASSIST). Therefore, it is recommended that these instruments are used in the future study to verify this study finding. Finally, it is suggested that future research investigate the relationship between learning performance and cognitive, psychomotor and affective variables, as well as personality factors and learning techniques.

CONCLUSION

This study indicated there was significant relationship of specific personality traits and learning approaches. Conscientiousness and neuroticism had significant relationship with deep and strategic learning approaches. The personality-learning approach relationship model provide a framework that enables medical educators to better understand the

influence of personality traits on medical students' learning approaches to learning tasks, which has implications on designing effective instructional strategies.

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ETHICAL APPROVAL

Prior to the study, the ethical approval was obtained from the institutional ethics committee (USM/JePEM/16090274).

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