The Effect of Big Five Personality Traits on Physics Education in Middle School: Evidence from a Chinese Study

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Abstract. To explore the correlation between personality traits and physics score, we enrolled 60 students as samples, and obtained their Big Five personality traits by NEO-FFI questionnaire. The average of the scores of the midterm examination and final examination of both Grade 7 and Grade 8 is used as the predictor variable. The correlation analysis showed that the conscientiousness is positively related to physics score, and the neuroticism is negatively related to physics score. Other three personality traits are not related to physics score.

Introduction

The Big Five personality traits (BFPT) measure is an important personality descriptor [1]. These measures contain five factors: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. In common, the aforementioned five factors are abbreviated as OCEAN. The BFPT has intimate connections with friendship [2], non-verbal intelligence [3], deviant behavior [4], internet addition [5], etc.

Except emotion and psychology, the scholars also investigated the relationship between Big Five personality dimensions with primary and secondary educations. de Bruin, et al. [6] explored whether scores on intelligence tests and personality questionnaires can predict performance in an adult basic education and training (ABET) program. Rammstedt, et al. [7] demonstrated the measurement equivalence of Big Five factor markers for persons with different level of education. Culjak and Mlacic [8] used Big Five model to predict the success of high school students. Smidt, et al. [9] provided a German study to discover how Big Five personality traits influence the early childhood pedagogues and their beliefs.

This study is a complementarity of aforementioned studies. Our contribution contains two points: (1) we enrolled Chinese intermediate students as subjects. (2) Our study is for physical education. The rest of this paper is structured as follows: Next Section 0gives the methodology. Section 0 presents the results and discussions. Finally, Section 0 concludes the paper.

Methodology

Subjects

We enrolled in total 60 junior middle school students (Grade 8), with their demographics listed in Table 1. There are 29 male students and 31 female students. From the view of age, there are 19 students with age of 13, 24 students with age of 14, 13 students at age of 15, and 4 students at age of 16. There are 32 students follows one-child policy. All students live in the city.

Table 1 Demographics of 60 subjects from a junior middle school

Characteristics	Value
Gender	Male (29), Female (31)
Age	13 (19), 14 (24), 15 (13), 16 (4)
One-Child	No (32), Yes (28)
Location	City (60), Suburb (0)
Grade	Grade 8 (60)

(The digits in the parenthesis represent the number of people)

Questionnaire

The revised NEO personality inventory (NEO PI-R)[10] contains in total 240 items. Two forms exist: self-report and observe report. It costs too much time for the students to finish that questionnaire; hence we used the shortened version, 60-item inventory, named asNEO-Five Factor Inventory (NEO-FFI)[11]. The personality dimension and corresponding facets are listed in Table 2. Note that NEO was considered as Neuroticism-Extroversion-Openness Inventory, but now it is no longer an acronym. The scores of this 60-item NEO-FFI were used as the dependent variable.

Table 2 Personality dimension

Personality dimension	Facets
Openness to experience	Fantasy, Aesthetics, Feelings, Actions, Ideas, Values
Conscientiousness	Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, Deliberation
Extraversion	Warmth, Gregariousness, Assertiveness, Activity, Excitement Seeking, Positive Emotion
Agreeableness	Trust, Straightforwardness, Altruism, Compliance, Modesty, Tender mindedness
Neuroticism	Anxiety, Hostility, Depression, Self-Consciousness, Impulsiveness, Vulnerability to Stress

We record the scores of the midterm examination and final examination of both Grade 7 and Grade 8. The averaged physical exam score was used as the predictor variable.

Software

We used Matlab 2016b as the computing platform. Correlation analysis [12]was used to make statistical test whether Big Five personality dimension is related to physics score. The command "corr", shown in Table 3, was used to carry out the correlation analysis. The command outputs the linear correlation coefficient (ρ) and the p-value (P).

Table 3 Matlab command of "corr"

$[\rho, P] = corr(X,Y)$
Input X: dependent variable Y: independent variable
Output ρ: linear correlation coefficient P: p-values

The Pearson's linear correlation coefficient was calculated based on the "corr" command. Two-tailed tests are used. The alternate hypothesis is that the correlation is not zero, and the null hypothesis is that the correlation is zero.

Results and Discussions

Table 4 Correlation analysis of physics score with gender, age, and one-child factors

	Gender	Age	One-child
ρ	-0.010	-0.2148	-0.0039
P	0.9335	0.0993	0.9764

Table 5 Correlation analysis of physics score with gender, age, and one-child factors

	Openness to experience	Conscientiousness	Extraversion	Agreeableness	Neuroticism
ρ	0.1564	0.3941	0.0872	-0.0738	-0.3582
P	0.2327	0.0018*	0.5076	0.5752	0.0050*

(*P<0.05)

Table 4 shows that the gender, age, and one-child policy do not have significant correlation with physics scores. Table 5 shows that the conscientiousness is positively correlated with physics score (ρ = 0.3941, P = 0.0018). This result can help our teachers in cultivating students in learning physics. Except the contents in the textbook, the teachers should cultivate students in the characteristics of self-discipline and striving for achievement. Besides, the students should learn control and regulate themselves. Spontaneous behaviors should be avoided.

Table 5 also shows that the neuroticism is negatively correlated with physics score (ρ = -0.3582, P = 0.0050). The result indicates that calm and emotional stability can benefit physics learning. The students should be far away from negative emotions.

The questionnaire is somewhat subject, and may be influenced by personal feelings. We shall try to use neuroimaging techniques, e.g., the magnetic resonance imaging [13-18], to scan the brain to obtain its structure and functioning states. More advances statistical techniques, computer vision methods [19, 20], and artificial intelligence approaches [21, 22] shall be tested.

Conclusions

In this study, we find the conscientiousness is positively related to physics score, and the neuroticism is negatively related to physics score. Other three personality traits are not related to physics score.

In the future, we shall try to use the NEO PI-R questionnaire. We shall also collect the scores of the students on mathematics, English, chemistry, history, etc. We shall use correlation analysis to know their relationship with Big Five personality traits.

Acknowledgement

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