



Personality and Family Context in Explaining Grit of Taiwanese High School Students

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ABSTRACT

Grit, one of the newly developed non-cognitive traits, encompasses the characteristics of perseverance and consistency of interest. Grit is associated with good academic performance, resilience, and well-being. To understand the nature of Grit in detail, this study probed the relationship between Grit and the widely-applied and well-established Big-Five personality. Family context plays a significant role in nurturing all aspects of personality traits. Accordingly, we examined two family-context variables, namely family influence and democratic parenting style, which may be predictive of Grit, particularly in an Asian context.

A total of 1504 students from one private comprehensive high school participated. Multiple linear regression was conducted to determine how the various independent variables affect Grit characteristics. The results indicate that grittier high school learners tend to display higher self-report academic performance and academic satisfaction. Multiple regression demonstrated that the four Big-Five personality traits: Agreeableness, Conscientiousness, Neuroticism, Intellect/Imagination, are significantly predictive of Grit, with the exception of Extraversion. While family influence is predictive of Grit, democratic parenting style does not predict Grit. Based on the results, several possible explanations and suggestions are proposed.

Keywords: family influence, big-five personality traits, grit characteristics, democratic parenting style

INTRODUCTION

Citizens in the workplace or students at school may encounter various challenges, such as dealing with academic/work issues and meeting social expectations. Accordingly, perseverance, tenacity, and grit are critical characteristics for humans in the twenty-first century (U.S. Department of Education 2013). Unlike traditional cognitive traits (e.g., problem solving ability), the non-cognitive trait of Grit may be educationally meaningful, and of value throughout lifespan. Grit, one of the newly developed non-cognitive traits, encompasses the characteristics of perseverance of effort and consistency of interest, and is associated with good academic performance, resilience, and well-being (Duckworth,

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State of the literature

- Grit, includes two major characteristics: perseverance of effort and consistency of interest, is a valuable non-cognitive trait for not only achieving good academic performance but also accomplishing personal goals.
- Few studies have explored how personality traits and family context are able to shape the characteristics of Grit.
- Big-Five personality and two family-context variables (family influence and democratic parenting style) could be predictive of Grit.

Contribution of this paper to the literature

- 'Grittier' high school learners tend to self-report higher academic performance and academic satisfaction.
- Agreeableness, Conscientiousness, Neuroticism, Intellect/Imagination were predictive of Grit whereas Extraversion was not.
- Family influence predicted Grit; however, democratic parenting style was not predictive of Grit.

Peterson, Matthews, and Kelly 2007; Eskreis-Winkler, Shulman, Beal, and Duckworth 2014). To more fully understand the nature of Grit, and the relationship between Grit and the Big-Five personality traits would provide a meaningful reference for educators and researchers. Additionally, the family environment (e.g., parenting style) shapes profoundly the personality of adolescents (Brand, Hatzinger, Beck, and Holsboer-Trachsler 2009; Fu and Markus 2014). This study examined the extent to which the Big-Five personality traits and two family context variables, namely perceived family influence and democratic parenting style, can predict the characteristics of Grit.

The Grit personality trait

Grit is an individual characteristic, characterized by persevering and maintaining focus on interests or projects (Duckworth et al. 2007). Grit has been found to be a critical psychological feature and shown to be predictive not only of academic-related performance such as GPA, graduation rate, and retention, but also of non-academic outcomes such as well-being and life satisfaction (Duckworth et al. 2007; Eskreis-Winkler et al. 2014; Von Culin, Tsukayama, and Duckworth 2014). Interest theory and motivational theory are of relevance for understanding the development of Grit characteristics. Interest development involves affective (i.e., positive feelings) and cognitive mechanisms (Hidi 2006). Temporary situational interest can be triggered by various instructional activities, such as providing stimuli, physical activity, and choices (Palmer 2009; Rotgans and Schmidt 2011). Situational interest can transform into individual interest, which is persistent and can be maintained for a longer period of time. When an interest is identified, the individual is ready to not only invest his or her energy, but also meet the challenges of interest-related tasks, and is able to be persistent in pursuing goals (Renninger 2009). For example, Maltese, Melki, and Wiebke

(2014) found that intrinsic passion and interest are the major reason why individuals persist in pursuing the STEM field.

Secondly, research on motivation is able to delineate both the individual's characteristics for intensive engagement and the Grit-supported context. Empirical evidence for self-determination theory has demonstrated that an autonomy-supported context rather than a controlled context can nurture adaptive motivation and engagement (Hardre and Reeve 2003). In achievement goal theory, adopting a mastery goal rather than a performance or avoidance goal can help school students exhibit intensive engagement (Gonida, Voulala, and Kiosseoglou 2009). In flow theory, the experience of flow is associated with higher concentration, interest, and engagement (Shernoff, Csikszentmihalyi, Schneider, and Shernoff 2003). The classroom context should provide an optimal challenge that provides a goal that is important to the individual, and which matches his or her competence. Based on the aforementioned evidence, a supportive context that optimally promotes Grit should be mastery-goal oriented, and should satisfy an individual's need for autonomy, competence, and belonging, as well as provide an optimal challenge that matches the individual's competencies.

The Big-Five personality traits and Grit

The Big Five personality traits have been of utility in understanding the learning process and learning outcomes (Komarraju, Karau, Schmeck, and Avdic 2011; Laidra, Pullmann, and Allik 2007). Moreover, cultural values embedded in society and the family context provide children and adolescents with interests, habits, and personality traits such as perseverance, responsibility, independence, and hard work (Mendez, 2015). Possible relationships between the Big Five personality traits and Grit are described below.

Conscientiousness and Grit

Conscientiousness includes the traits of orderliness, dutifulness, and self-discipline and is one of the clearest predictors of positive learning styles and outcomes (O'Connor and Paunonen 2007). Grit is defined by two components: perseverance of effort and having a consistent level of interest. These features of Grit define an individual who is well-motivated and who has specific individual interests, both of which are advantageous features for effective learning (Vansteenkiste, Simons, Lens, Sheldon, and Deci 2004). Ivcevic and Brackett (2014) noted that Grit is more predictive of self-selected goals, such as extracurricular activities, in contrast to Conscientiousness, which is a broader trait that is predictive of school success. The relationship between Grit, a motivating but narrow, trait and Conscientiousness, a broader trait, is still unclear. Exploring the relationship between Grit and Conscientiousness would facilitate an understanding of how the Grit trait of intrinsic goal pursuit is correlated with Conscientiousness, the latter of which consists of the primary traits of orderliness, dutifulness, and self-discipline.

Agreeableness and Grit

Agreeableness consists of the traits of sympathizing with others' feelings and consideration of others. Trait Agreeableness is beneficially related to several learning-related features such as academic performance (Vedel 2014) and self-regulated ability (Jensen-Campbell et al. 2002). When an individual possesses stronger trait Agreeableness, they should be able to access more resources and be supported by significant others. Sympathizing with others is socially appropriate in the school context. It is this important to determine whether trait Agreeableness is predictive of Grit.

Intellect/Imagination and Grit

Intellect/Imagination includes the traits of curiosity and imagination. Students with stronger traits Intellect/Imagination are well-motivated toward gaining knowledge, pursuing understanding, and displaying deep engagement (Komarraju and Karau 2005). It is plausible that students with stronger Intellect/Imagination trait would tend to persevere in pursuing designated projects and would maintain consistent interest. However, Bidjerano and Dai (2007) found that individuals with stronger trait Intellect/Imagination may not be equipped with adaptive learning strategies. It is likely that students with the stronger trait Intellect/Imagination should be supported with suitable learning strategies. Whether Intellect/Imagination can predict Grit is an important question.

Neuroticism and Grit

Students with the stronger trait Neuroticism tend to be occupied with emotions such as anxiety, anger, or depression. Most studies have found that Neuroticism is negatively correlated with academic performance, positive affect, and well-being (Chamorro-Premuzic and Furnham 2003; Laidra et al. 2007). School students with the stronger trait Neuroticism may have little energy available to concentrate on pursuing their goals and relevant projects. High school students in East Asian countries tend to experience the pressure of both school work and high-stakes testing for entering college. Whether Neuroticism is negatively predictive of Grit among these high school students should be explored further.

Extraversion and Grit

Extraversion consists of traits of gregariousness and sociability. Studies have found inconsistent relationships between Extraversion and aspects of learning (Komarraju and Karau 2005; O'Connor and Paunonen 2007). Trait Extraversion longitudinally decreases from adolescence to adulthood (Branje, van Lieshout, and Gerris 2007). Extraversion tends to be a positive trait in explaining academic performance of elementary graders, and transforms into an insignificant or negative predictor for high school students and undergraduates, who need higher cognitive capabilities to cope with their workload (Branje et al. 2007; Laidra et al. 2007). High school students with stronger trait Extraversion tend to spend more time on social activities rather than maintaining focus on their interests or projects. Extraversion may not be beneficial for high school students when they are confronted with higher academic

demands. However, Zhai, Willis, O'Shea, Zhai, and Yang (2013) found that Extraversion can be beneficial to adults' wellbeing in China. Therefore, whether Extraversion is predictive of Grit among Asian high school students remains unclear.

Family context and Grit

Family context profoundly influences adolescents' interests and personality by various means, such as parental occupation, family hobbies, and familial encouragement (Dabney, Chakraverty, and Tai 2013; Dietrich and Kracke 2009). Family members, especially parents, may support, interfere with, or neglect adolescents, thus influencing the latter's motivations, interests, and personality traits (Dietrich and Kracke 2009).

How adolescents perceive the influence of their family can indicate the degree of interdependency. Fu and Markus (2014) noted that Asian and European American descent have distinct ways of perceiving family influence. Teenagers of Asian Americans perceived strong family influence (high interdependency) from their mothers, and they also received more pressure and support from their mothers with respect to pursuing their goals. However, high school students of European-American ancestry perceived more autonomy but less support within their more individualistic family context.

Another variable that defines the family context is parenting style (e.g., authoritative, authoritarian, permissive, or democratic), which nurtures family members differently (Bryant, Zvonkovic, and Reynolds 2006; Chan and Chan 2009). A democratic parenting style indicates that parents provide abundant autonomy and room for exploration. A democratic parenting style may nurture adaptive emotions, intrinsic motivation, efficacy, and personal interest (Brand et al. 2009). In contrast, studies have indicated that when parents emphasize extrinsic or performance-goal aspirations, such emphasis is related to less positive school functioning and poorer self-regulated learning behavior among teenagers (Mouratidis, Vansteenkiste, Lens, Michou, and Soenens 2013). Therefore, the democratic family context may not be linked to the facilitation of Grit.

METHOD

The purpose of this study was to examine how family influence, democratic parenting style, and the Big Five personality traits can predict the characteristics of Grit.

Participants

We surveyed 1504 high school 10th grade students from one private comprehensive high school in central Taiwan, including individuals taking general high school courses and vocational courses. With the help of school administrators and the home-room teachers, all tenth graders of this school were surveyed at the beginning of their first semester in September 2013. This sampled school possesses good representative of high school sample profile in Taiwan. Previous study has indicated that the score of the General Scholastic

Ability Test (GSAT)(i.e., The College Entrance Examination) of this sampled school is able to represent the national probability distribution in Taiwan (Chang and Cheng, 2008).

Instruments

The Grit-S Scale and the Mini-IPIP Scale were completed by the participants. Both scales use 5-point Likert-type scales ranging from 1 (not at all like me) to 5 (extremely like me).

The Grit-S Scale

The Grit-S scale consists of 8 items (Duckworth & Quinn, 2009) that form two subscales, namely Consistency of Interests and Perseverance of Effort. Consistency of Interests (4 items) measures the degree to which an individual persists in pursuing interests (e.g., “New ideas and new projects sometimes distract me from previous ones”) (reverse coded). Perseverance of Effort.” (4 items) measures the degree to which an individual persists with accomplishes tasks (e.g., “I have overcome setbacks to conquer an important challenge”).

Table 1. Exploratory factor analysis of the Grit-S scale

Subscales & items	Mean	EFA loading	Variance explained	Alpha
Grit: Consistency of interests		-----	33.13	0.68
CO1: New ideas and new projects sometimes distract me from previous ones.*	3.01	0.57		
CO2: I have been obsessed with a certain idea or project for a short time but later lost interest.*	3.20	0.76		
CO3: I often set a goal but later choose to pursue a different one.*	3.12	0.75		
CO4: I have difficulty maintaining my focus on projects that take more than a few months to complete.*	3.16	0.71		
Grit: Perseverance of effort			20.18	0.70
PE1: I have overcome setbacks to conquer an important challenge.	3.07	0.56		
PE2 : I am a hard worker.	3.32	0.76		
PE3 : I finish whatever I begin.	3.21	0.72		
PE4: I am diligent.	3.20	0.83		

Note: Item with asterisk is reverse scored

Exploratory factor analysis was conducted to understand the use of The “Grit-S scale” for Taiwanese high school students in an East Asian country. Kaiser-Meyer-Olkin (KMO) indicators and Bartlett’s test were used to examine the appropriateness of performing exploratory factor analysis. Items with factor loadings lower than 0.40 were ruled out in

order to satisfy the validity of the scale. Having an eigenvalue above 1 was the criterion for determining the number of factors.

The results of exploratory factor analysis indicated that the value of KMO test for the “Grit-S scale” was above 0.75 and the Bartlett’s test of this scale was significant ($p < 0.01$), indicating good properties for performing exploratory factor analysis. Using the method of principal component factoring and varimax rotation, the results of factor analysis displayed that the original construct of the two subscales was supported and items for each subscale were all retained because of satisfactory factor loading index (all above 0.50). The “Grit-S scale” explained 53.31 % of the variance and alpha coefficient of the two subscales was 0.68 for “Grit: Consistency of interest” and 0.70 for “Grit: Perseverance of effort”. The EFA results indicated that The “Grit-S scale” had good construct validity and reliability (see **Table 1**).

The Mini-IPIP Scale

The Mini-IPIP Scale has been widely used in various contexts and with a variety of participants. This concise version measures the Big-Five personality traits with satisfactory reliability and validity (Baldasaro, Shanahan, and Bauer 2013; Cooper, Smillie, and Corr 2010; Donnellan, Oswald, Baird, and Lucas 2006).

1. “Extraversion” (four items) probes the degree to which an individual exhibits the characteristics of extraversion (e.g., “Talk to a lot of different people at parties”).
2. “Agreeableness” (four items) examines the degree to which an individual is inclined to sympathizing others’ feelings (e.g., “Sympathize with others’ feelings”).
3. “Conscientiousness” (four items) measures the degree to which an individual displays the characteristics of being organized and hard-working (e.g., “Get chores done right away”).
4. “Neuroticism” (four items) measures the degree to which an individual exhibits the

Table 2. One-way ANOVA on self-reported academic performance with post-hoc

	Academic performance ranking	N	Mean	SD	F-value	Post-hoc comparison
Grit-S Scale	Top 33%	490	3.27	0.50	29.71***	Top 33% > Middle 33% > Bottom 33%
	Middle 33%	730	3.16	0.50		
	Bottom 33%	284	2.98	0.52		
	Total	1,504	3.16	0.51		
Consistency of Interests	Top 33%	490	3.20	0.61	10.19***	Top 33% > Middle 33% > Bottom 33%
	Middle 33%	730	3.12	0.63		
	Bottom 33%	284	2.99	0.70		
	Total	1,504	3.12	0.64		
Perseverance of Effort	Top 33%	490	3.33	0.67	27.75***	Top 33% > Middle 33% > Bottom 33%
	Middle 33%	730	3.20	0.63		
	Bottom 33%	284	2.97	0.72		
	Total	1,504	3.20	0.67		

*** $p < 0.001$

traits of being emotional (e.g., “Get upset easily”).

5. “Intellect/Imagination” (four items) measures the degree to which an individual reports having good imagination (e.g., “Do not have a good imagination”) (reverse coded).

Items for democratic parenting style, family influence, academic performance, and academic satisfaction

Democratic parenting style measures the degree to which an individual perceives their family adopts a democratic parenting style. Three items (e.g., “To what extent is your fathers’ parenting style democratic?”) were rated on a scale of 1 to 5.

Family influence measures the degree to which an individual perceives he or she is influenced by his or her family. Three items (e.g., “To what extent do you perceive your father has an influence on your learning and daily life?”) were rated on a scale of 1 to 5.

Academic satisfaction assesses an individual’s self-reported academic satisfaction, ranging from a lowest score of 1 to a maximum score of 5 (1 item).

Academic performance measures an individual’s self-reported academic performance, according to one of three selections: ranked in the top 33% in the class, ranked in the middle 33%, and ranked in the last 33% of the class (1 item).

Table 3. One-way ANOVA on academic satisfaction with post-hoc comparisons

	Academic satisfaction	N	Mean	SD	F-value	Post-hoc comparisons
Grit-S Scale	1	260	2.98	0.528		
	2	508	3.13	0.478		
	3	578	3.22	0.494		5 > 1; 4 > 1,2; 3 > 1;
	4	117	3.37	0.501		2 > 1
	5	41	3.26	0.739		
	Total	1,504	3.16	0.514	16.66***	
Consistency of Interests	1	260	3.00	0.72		
	2	508	3.11	0.61		
	3	578	3.18	0.61		
	4	117	3.19	0.62		
	5	41	3.09	0.93		
	Total	1,504	3.12	0.64	4.12**	3 > 1
Perseverance of Effort	1	260	2.96	0.70		
	2	508	3.15	0.61		
	3	578	3.26	0.63		5 > 1; 4 > 3,2,1; 3 >
	4	117	3.56	0.62		1; 2 > 1
	5	41	3.43	1.06		
	Total	1,504	3.20	0.67	21.04***	
	Total	1,504	2.98	0.68	7.45***	

** $p < 0.01$, *** $p < 0.001$. Note: Self-reported academic satisfaction ranged from a lowest possible score of 1 to a highest possible score of 5.

Table 4. Correlations between scores of the Grit-S Scale, Big-Five Mini-IPIP Scale, and family context variables

Scale/subscale	Mean (SD)	1	2	3	4	5	6	7	8	10	11
1. Grit-S Scale	3.16 (0.51)	1.00									
2.Grit: Consistency of Interests	3.12 (0.64)	.77**	1.00								
3.Grit: Perseverance of Effort	3.20 (0.67)	.79**	.23**	1.00							
4.Big Five: Extraversion	3.32 (0.80)	.15**	.08**	.15**	1.00						
5. Big Five: Agreeableness	3.76 (0.63)	.25**	.12**	.26**	.49**	1.00					
6. Big Five: Conscientiousness	3.36 (0.62)	.50**	.34**	.44**	.06*	.23**	1.00				
7. Big Five: Neuroticism	2.98 (0.68)	-	-	-	-	-.06*	-	1.00			
8. Big Five: Intellect/Imagination	3.46 (0.74)	.20**	.16**	.16**	.22**	.20**	.08**	-	1.00		
9. Democratic parenting style	3.93 (0.85)	.15**	.06*	.16**	.08**	.09**	.13**	-	.16**	1.00	
10.Family influence	3.68 (0.88)	.18**	.09**	.18**	.08**	.13**	.15**	-.03	-.02	.46**	1.00

N = 1504. ** $p < 0.01$ (two-tailed), * $p < 0.05$ (two-tailed).

Proposed causal model and data analysis

Based on the above literature review, the present study proposed a causal relationship between Grit as the dependent variable and the Big-Five personality traits and two of the family context variables (i.e., family influence and democratic parenting style) as independent variables. Multiple regression analysis, correlation analysis, and ANOVAs were used to examine the relationships among variables.

RESULTS

ANOVA on Grit-S scores by academic performance

An ANOVA was used to examine the mean differences in Grit-S scores among the three groups of self-reported academic performance (i.e., ranked as the top 33%, the middle 33%, and the bottom 33%). Tukey’s HSD method was used for post-hoc comparisons. Results indicated that three groups of self-reported academic performance displayed significant differences (Table 2). High school students who self-reported their academic performance as the top 33% produced significantly higher scores on the Grit-S Scale and its two subscales (Consistency of Interests and Perseverance of Effort) than students who self-reported academic performance as the middle 33% or the bottom 33% in the class.

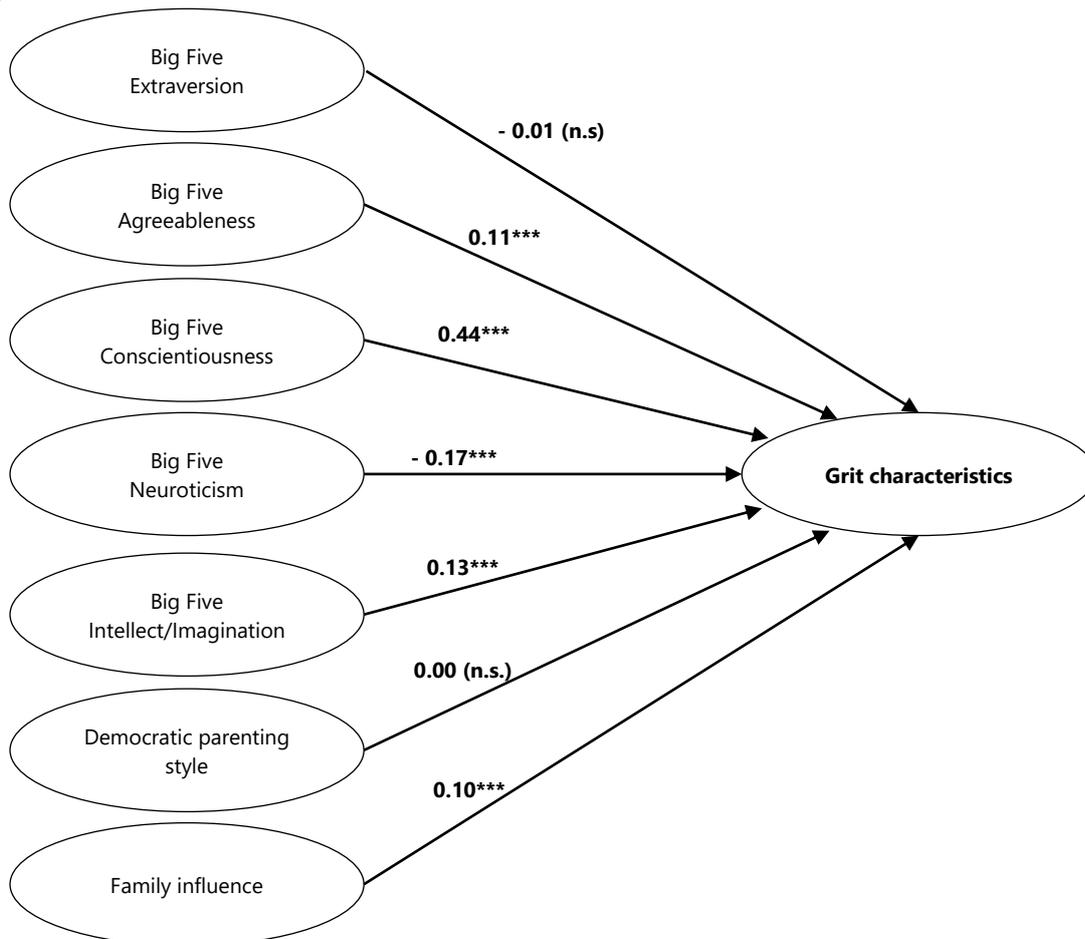
ANOVA on Grit-S scores by academic satisfaction

An ANOVA was used to examine mean differences in Grit-S scores among the five

Table 5. Multiple regression model of Grit

Independent variables	Unstandardized coefficient	Standardized coefficient	t-value	p	VIF
Constant	1.49		12.45	0.000	
Big Five: Extraversion	0.00	-0.01	-0.22	0.826	1.42
Big Five: Agreeableness	0.09	0.11	4.18***	0.000	1.41
Big Five : Conscientiousness	0.36	0.44	19.62***	0.000	1.09
Big Five : Neuroticism	-0.13	-0.17	-7.60***	0.000	1.09
Big Five : Intellect/Imagination	0.09	0.13	6.00***	0.000	1.08
Democratic parenting style	0.00	0.00	-0.01	0.988	1.31
Family influence	0.06	0.10	3.95***	0.000	1.30
F	124.09***				
R-square	.350				
Adj R	.347				

***p < 0.001



* p < .05 ; ** p < .01 ; *** p < .001

Figure 1. The results of the regression model

groups of academic satisfaction ranging from 1 (lowest) to 5 (highest). Grit-S differed significantly among the five academic satisfaction groups. Post-hoc comparisons indicated that high school students who self-reported higher academic satisfaction produced significantly higher scores on the Grit-S scale and the subscales Consistency of Interests and Perseverance of Effort (**Table 3**).

Correlation between the Grit-S Scale and the Mini-IPIP Scale

The Grit-S Scale and its two subscales were significantly and positively correlated with all subscales of the Mini-IPIP ($p < 0.05$) except Neuroticism, which was negatively correlated with all other subscales. There was a relatively large correlation ($r = 0.50$, $p < 0.01$) between the Grit-S Scale and Mini-IPIP Conscientiousness (**Table 4**).

Multiple linear regressions for the Grit-S Scale

A multiple linear regression using the enter method was conducted to investigate the causal relationships between Grit scores as the dependent variable and the five Mini-IPIP subscales and two family context variables (family influence and democratic parenting style) as independent variables (see Table 5 and Figure 1). The multiple regression model was statistically supported ($F = 124.09$, $p < 0.001$; Adjusted R-square = .347). VIFs greater than 10 denote multicollinearity: The VIFs of this regression model were less than 2 (**Table 5**).

Among the seven independent variables, two were not significantly related to Grit (Mini-IPIP Extraversion: $t = -0.22$, n.s.; democratic parenting style: $t = -0.01$, n.s.). Among the five significant independent variables, Mini-IPIP: Conscientiousness was the most significant predictor ($t = 19.62$, $p < 0.001$) followed by Mini-IPIP: Neuroticism ($t = -7.60$, $p < 0.001$), Mini-IPIP: Intellect/Imagination ($t = 6.00$; $p < 0.001$), Mini-IPIP: Agreeableness ($t = 4.18$, $p < 0.001$), and family influence ($t = 3.95$, $p < 0.001$; see **Table 5**).

DISCUSSION

Based on the results of multiple regression and ANOVAs, the following explanations and practical implications are suggested.

The Grit personality type robustly predicts academic performance and satisfaction

The ANOVA results indicated that high school students who were higher scores in Grit (i.e., those who persevered and maintained focus on projects) self-reported greater academic performance and academic satisfaction. Grit, a non-cognitive trait, may engender a recursive process that includes positive learning features (Yeager and Walton 2011). Grit may trigger advantageous cognitive, emotional, and behavioral mechanisms or resources (e.g., self-regulated learning strategies), which may be beneficial to academic-related outcomes (Bidjerano and Dai 2007).

The Big-Five personality traits and Grit

This study found that four of the Big-Five personality traits – Agreeableness, Conscientiousness, Neuroticism, and Intellect/Imagination – significantly predicted Grit. Extraversion was not predictive of Grit.

Conscientiousness was the most powerful positive predictor of Grit, showing that high school students who are conscientious, orderly, disciplined, and organized tend to persist in accomplishing their goals and maintain consistent interests. Previous studies have indicated that the adoption of future intrinsic goals can facilitate instrumental goals and self-regulated behaviors (Tabachnick, Miller, and Relyea 2008). Our results indicate that Conscientiousness, which comprises primary and instrumental behaviors, is predictive of Grit, which includes intrinsically oriented goal behaviors.

Intellect/Imagination positively and significant predicted Grit. This may be because high school students who are curious and intellectual are likely well-motivated, with identified topics or knowledge of interest to them; therefore, they persistently maintain focus and become involved in their own interests or projects.

Agreeableness was predictive of Grit, showing that high school students who were cooperative and sympathetic have stronger trait of Grit. Agreeable students have positive relationships with significant others and are able to persist in completing projects. With the need for relatedness satisfied (i.e., belongingness), they not only support others but are also supported, such as when seeking help (Bidjerano and Dai 2007).

Neuroticism was a negative predictor of Grit, indicating that high school students who were less emotionally stable tended to possess fewer characteristics of Grit. High school students who are high in Neuroticism cannot have limited energy to dedicate to exploring interests and nurturing the motivation for domain knowledge or project completion. Additionally, high school students, especially in East Asian countries, experience high academic pressure (e.g., College Entrance Examination) and emotions such as anxiety and anger may occur as a consequence. Equipping students with the ability to regulate their emotions, Grit, or resilience is of great importance for educational administrators and teachers.

Extraversion was unrelated to Grit, implying that high school students who were sociable and extroverted were not notably likely to exhibit Grit. This is likely because high school students with stronger trait Extraversion do not invest considerable energy on tasks of interest. School administrators should create a suitable context for this profile of students, which could help extrovert learners develop individual interests and self-regulation, so as to engender intrinsic motivation and the maintenance of focus on their projects.

Grit and family context: Democratic parenting style and family influence

Based on the regression results, family influence (i.e., the individual's perception that he or she is influenced by his or her family) predicted Grit; however, democratic parenting style did not. The underlying reason for these results is that family influence and democratic parenting style represent distinct ideologies in the family context: collectivism versus individualism (Chirkov, Ryan, Kim, and Kaplan 2003). In a collectivistic family context, a high school student perceives strong family influence and can be provided with not only abundant psychological and social support, but also pressure and expectations when facing various academic or nonacademic short-term or long-term goals. This family profile can facilitate perseverance (Fu and Markus 2014). In contrast, in an individualistic family context a high school student can be provided with abundant autonomy with which to nurture self-accomplishment and experience. This democratic parenting style might better facilitate the exploration of personal interests and enhance efficacy of learning. A high school student in a democratic family context might not be expected to persevere in accomplishing learning tasks or personal interests. Exploring personal interests and short- or long-term goals is more common in an autonomous family context, which may not directly promote a teenager's perseverance and maintaining consistent interests.

Future studies and limitations

School administration and instructional practice should provide an adaptive school context, with learning activities that meet the needs of students with different personality profiles. High schools should not only promote the characteristics of Grit, Conscientiousness, Agreeableness, and Intellect/Imagination, but also help cultivate emotional regulation abilities, so as to reduce the negative effects of stress and emotions on high school students (Wagner and Ruch 2015). Furthermore, the family context influences Grit profoundly. A project for parent-teacher cooperation should be implemented so as to facilitate mutual understanding and cooperation between parents and teachers.

The first limitation and also the suggestion for future studies is that the present study is not able to reveal the curvilinear relationship between Grit and the Big five personality traits. For example, one with extreme Conscientiousness may not also exhibit the corresponded linear relationship with Grit. Future studies are suggested to examine nonlinear relationship between the two variables. More specifically, Grit personality can be educational meaningful though. The extreme Grit learners may focus too much on student personal interest or the involved project, which may result in maladaptive perfectionism or obsessive passion. The stronger trait of Grit might be detrimental to social-emotional coping, well-being, and mental health (Ulu and Tezer, 2010). In the classroom level, students might be pressured to study uninterested learning materials or unrelated contents to their life experiences. The designed program should consider these socio-cultural and individual differences to avoid the possible detrimental effect in promoting grit.

The second limitation and also the suggestion is that the present study applies self-report method, which can cause subjective-validity bias. Applying other-report method (e.g., peer-or teacher-rated) (Vianello, Robusto, and Anselmi, 2010), or implicit measure (e.g., Implicit Association Test), which can increase internal validity of the study. In addition, this study surveyed high school students of an East Asian country, Taiwan. The cultural issue and the socioeconomic status of these subjects could be the limitations to generalize the results of this study.

The third limitation and also the suggestion is that there might be some moderating or mediating variables existed between personality and Grit behavior such as classroom context (e.g., reward system; goal structure; instructional strategies), family environment (e.g., expectation), and social-cultural context (Barrick, Parks, and Mount, 2005; Tett and Burnett, 2003). For example, a highly autonomy and cooperative classroom can facilitate some types of personality traits. As for social-cultural differences, under the collectivistic culture, a high school student in his/her late adolescence may have to not only find his or her own identity but also meet the family or social expectations (e.g., entering a good college). Exploring how the personality traits, classroom context, and social-cultural context are correlated is suggested.

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