



## **Non-cognitive Skills and the Role of College Activities: an Empirical Study in Hong Kong**

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### **Abstract**

Increasing studies demonstrated the power of non-cognitive skills. However, the methods to improve students' non-cognitive skills are still not clear. The present paper was trying to investigate the correlations among different factors that related with non-cognitive skills, and to examine the contributions of teaching and extra-curricular activities in higher education on students' non-cognitive skills. Grit as one of the important non-cognitive skills was studied. An empirical study was conducted in a college located in Hong Kong by a questionnaire survey. 116 undergraduate students in different majors and in their 1st, 2nd, 3rd or 4th study year were randomly chosen. The Grit Scale developed by Duckworth et al (2007) was adapted, which subdivided grit into two factors assessing perseverance of effort and consistency of interests. The results indicated that the students with higher GPAs were not grittier than other students. The students who more believed in the power of grit were grittier. Well-designed teaching activities positively contributed to students' grit. However, extra-curricular activities indicated different patterns of contributions to grit, perseverance of effort and consistency of interests.

**Key Words:** non-cognitive skills, grit, college activities, undergraduates

## Introduction

What are the important skills for students' whole life? In the past, cognitive skills were the focus. With the coming of the Information Age, it calls for comprehensive skills other than cognitive skills. So far, a plenty of studies have demonstrated the importance of non-cognitive skills in predicting academic achievements (Jacob, 2002; DiPrete & Jennings, 2012; Mendez, 2015), social outcome (Cutler, Huang & Lleras-Muney, 2015) and students' successes in the labour market (Duncan & Dunifon, 1998; Heckman, Rubinstein, 2001; Heckman & Kautz, 2012; Heineck, 2011; Fletcher, 2013). Farkas has an excellent review about the role of non-cognitive skills in social stratification (Farkas, 2003). Many studies also indicate that non-cognitive skills are critical for college enrolments, student retention and study behaviours in college (Brown, 2012; Delaney, Harmon, & Ryan, 2013).

The definition of non-cognitive skills has not been clearly identified so far. Heckman & Kautz (2012:451-464) defined non-cognitive skills as "personality traits, goals, motivations, and preferences that were valued in the labour market, in school, and in many other domains". OECD identified a conceptual framework of non-cognitive skills with three domains and nine sets of non-cognitive skills, including pursuing goals(perseverance, self-control, passion for goals), working with others (friendliness, respect, caring) and managing emotions(calm, optimism and confidence) (OECD, 2015:34).

## Grit

Non-cognitive skills refer to many kinds of skills, but not only one universal skill. Grit is an important non-cognitive skill that is crucial for students' whole life. Duckworth, Peterson, Matthews & Kelly (2007) found that grit was an important factor to explain the variance in students' successes and was not significantly related with students' IQs. Grit was defined as "perseverance and passion for long term goals" (Duckworth et al, 2007:1087). Baum (2004) found that perseverance was an important entrepreneurial trait. Markman, Baron & Balkin (2005) (2005) demonstrated that entrepreneurs had higher self-efficacy and perseverance. The difference between grit and perseverance is that "grit" emphasized the persistence in long-term goals.

Although the power of grit is increasingly recognized, the ways to foster or improve grit through schooling are still not very clear. OECD (2015:40-41) mentioned that schooling was one of the important learning contexts to promote the development of non-cognitive skills, and curricular and extracurricular activities in schools were important factors to shape skills. This paper tried to contribute to educational practices through analysing the relations among different factors that may have effects on grit, considering teaching and extracurricular activities in college. This paper also contributed to the measurement of grit by translating and adapting the Grit Scale developed by Duckworth et al (2007) in the Chinese context.

## Method

### Participation

In this study, a specific college located in Hong Kong was chosen to be studied. All the undergraduates in this study were randomly selected. A total of 143 questionnaires were provided. 27 questionnaires were rejected because of inadequate or invalid information. Finally, 116 questionnaires were considered to be valid. The study was carried out in 2014.

Of the valid sample, college students were in their 1st, 2nd, 3rd, 4th study year. The ages ranged from 17 to 24 years (mean age=19.37). Of all the participants, 46(39.7%) were males and

70(70.3%) were female. The majors covered literature, science, engineering, law, medicine, social science, business and education.

### Measurements

There were several parts in the research questionnaire to assess students' background information, grit (consistency of interest, perseverance of effort), belief in grit, college activities factors (exposure to teaching activities, perceived benefits from extra-curricular activities). All of these items in the questionnaire were scored with a 5-point Likert scale from 1 to 5. 1 represented "completely disagree"; 5 represented "completely agree".

The Grit Scale developed by Duckworth et al (2007) was adapted in this study to measure grit. It contains 12 items, and constructs grit into two factors, "consistency of interests" and "perseverance of effort". As the Grit Scale is valid for adolescents and adults, we adapted the original Grit Scale of Duckworth et al (2007) to measure undergraduate students' grit in this study. Six items in this scale needed to be scored in reverse. In order to ensure understanding, all these 12 items were translated into Traditional Chinese. The reliabilities (Cronbach's Alphas) of the Grit Scale in this study ranged from 0.61 to 0.751.

The scale to assess the student's belief in grit, exposure to teaching activities and perceived benefits from extra-curricular activities was self-developed, because no existing reliable scales could be adapted. The reliabilities ranged from 0.727 to 0.798.

## Results

### Factor Analysis for Measurements

For the Grit scale, a principal component analysis with a two-factor method was used to analyse grit. Two factors were identified. Table 1 shows the results. Items from 1 to 6 were grouped into a component named "consistency of interests". The remaining items were grouped into the other named "perseverance of effort". The results of grouping were in line with Duckworth et al (2007). Using reliability analysis, Cronbach's Alphas of the overall scale was 0.69, 0.751 for consistency of Interests subscale, and 0.610 for perseverance of effort.

Table 1 Factor Loadings for Principal Component Analysis with Oblique Rotation for the items of Grit<sup>1</sup>

Grit scale	Component	
	1	2
item1 <sup>r</sup>	<b>0.669</b>	0.027
item2 <sup>r</sup>	<b>0.475</b>	0.165
item3 <sup>r</sup>	<b>0.676</b>	-0.248
item4 <sup>r</sup>	<b>0.748</b>	-0.160
item5 <sup>r</sup>	<b>0.695</b>	0.221
item6 <sup>r</sup>	<b>0.647</b>	0.059
item7	-0.075	<b>0.564</b>
item8	-0.217	<b>0.366</b>
item9	0.197	<b>0.642</b>
item10	-0.121	<b>0.631</b>
item11	0.190	<b>0.612</b>
item12	0.235	<b>0.577</b>
Eigenvalue	2.957	1.992
% of Variance Explained	24.64	16.60

<sup>1</sup> Note: r means the item was scored in reverse.

Three factors were identified from the self-developed part in the questionnaire using principal component analysis with direct oblimin rotation method. Table 2 shows the results. The three factors were labelled as “belief in grit”, “exposure to teaching activities”, and “perceived benefits from extra-curricular activities”. Each factor contained 5 items.

The factor labelled as “belief in grit” was represented by the following items: “Perseverance is an essential capability”, “To achieve the goal, we must have perseverance”, “We should finish what we started”, “I want to be a person with perseverance”, and “It is very difficult for the person who lacks perseverance to succeed”.

The factor labelled as “exposure to teaching activities” was represented using 5 items: “Teachers often arrange learning activities for us, e.g. seminar, field survey”, “During the learning activities, teachers often ask us to make plans”, “Teachers often ask us to make our own learning objectives for each term”, “Teachers actively teach us to finish what we have begun”, and “Teachers actively teach us not to be discouraged easily”.

The factor labelled as “perceived benefits from extra-curricular” was represented by the following items: “Through participation in extracurricular activities, I gained more self-management skills, e.g. management by objectives, stress management, time management, emotional management and so on”, “Through participation in extracurricular activities, I know persisting in a goal is very important”, “Through participation in extracurricular activities, I feel that achieving goals need perseverance”, “Through participation in extracurricular activities, I feel more capable of focussing on one or more months to achieve a goal”, “Through participation in extracurricular activities, I feel that I won’t be upset even if I encounter difficulties in future”.

The reliability of “belief in grit” factor was 0.727. The reliability of “exposure to teaching activities” factor was 0.776. And, the reliability of “perceived benefits from extra-curricular activities” factor was 0.798.

Table 2 Factor Loadings for Principal Component Analysis with Oblique Rotation for the Items of Self-developed part in the questionnaire<sup>2</sup>

Items	Component		
	1	2	3
Perseverance is an essential capability	-0.115	<b>0.727</b>	0.076
To achieve the goal, we must have perseverance	0.000	<b>0.712</b>	0.118
We should finish what we started	-0.008	<b>0.604</b>	0.079
I want to be a person with perseverance	0.069	<b>0.759</b>	-0.150
It is very difficult for the person who lacks perseverance to succeed	0.287	<b>0.569</b>	-0.051
Teachers often arrange learning activities for us, e.g. seminar, field survey	-0.167	0.182	<b>0.649</b>
During the learning activities, teachers often ask us to make plans	0.088	0.103	<b>0.594</b>
Teachers often ask us to make our own learning objectives for each term	0.096	-0.003	<b>0.748</b>
Teachers actively teach us to finish what we have begun	0.273	-0.050	<b>0.687</b>
Teachers actively teach us not to be discouraged easily	0.037	-0.163	<b>0.829</b>
Through participating in extracurricular activities, I gained more self-management skills, e.g. management by objectives, stress management, time management, emotional management and so on	<b>0.550</b>	0.055	0.181
Through participation in extracurricular activities, I know persisting in a goal is very important	<b>0.751</b>	0.182	-0.017
Through participation in extracurricular activities, I feel that achieving goals need perseverance	<b>0.749</b>	0.107	-0.028
Through participation in extracurricular activities, I feel more capable of focussing on one or more months to achieve a goal	<b>0.760</b>	-0.049	-0.029
Through participation in extracurricular activities, I feel that I won't be upset even if I encounter difficulties in future.	<b>0.706</b>	-0.144	0.153
Eigenvalue	4.609	2.023	1.482
% of Variance Explained	30.729	13.485	9.881

### Correlation Analysis

Correlation analysis was used to find the relations among different factors including students' grit which were constructed into perseverance of effort and consistency of interests, belief in grit, exposure to teaching activities, and perceived benefits from extra-curricular (see table 3). Grade and calculative GPAs reported by students were also analysed.

Only students' belief in grit was significantly and positively correlated with students' grit ( $r=0.194$ ,  $p=0.037$ ). Students' GPAs ( $r=0.246$ ,  $p=0.045$ ), belief in grit ( $r=0.354$ ,  $p=0.000$ ), exposure to teaching activities ( $r=0.368$ ,  $p=0.000$ ), and perceived benefits from extra-curricular activities ( $r=0.293$ ,  $p=0.001$ ) were found to be significantly and positively correlated with perseverance of effort. However, the correlation between students' perceived benefits from extra-curricular activities and consistency of interests was significantly negative ( $r=-0.204$ ,  $p=0.028$ ). That was, the students who felt getting more benefits from extra-curricular activities were less likely to keep consistent in interests. One possible explanation was that those students who felt getting more benefits from extra-curricular activities usually changed interests and participated in different types of activities, but did not persisted in one kind of activities.

It is interesting that grade negatively correlated with perseverance of effort ( $r=-0.081$ ,  $p=0.385$ ), but significantly and positively correlated with consistency of interests ( $r=0.300$ ,  $p=0.001$ ). This suggested that senior undergraduates tended to be less perseverant, but were more likely to persist in a long term goal than junior undergraduates. This also indicated that it

<sup>2</sup> Note: The factor loading in bold type represents the highest loading value.

was necessary to predict students' grit by predicting perseverance of effort and consistency of interests separately.

Table 3 Correlation Coefficients of All Variables<sup>3</sup>

Variables	grit	perseverance of effort	consistency of interests
gender	0.032	0.132	-0.057
grade	0.175	-0.081	0.300***
GPA	0.023	0.246**	-0.163
students' belief	0.194**	0.354**	-0.009
exposure to teaching activities	0.12	0.368***	-0.117
perceived benefits from extra-curricular activities	0.016	0.293***	-0.204**

### Regression Analysis

Linear regression was used to predict students' grit including the two constructs of grit (i.e. perseverance of effort, consistency of interests). The multiple regression estimated models were:

$$\text{grit} = \alpha + \beta_1 \cdot \text{grade} + \beta_2 \cdot \text{GPA} + \beta_3 \cdot X_1 + \beta_4 \cdot X_2 + \beta_5 \cdot X_3 + \varepsilon \quad (1)$$

$$\text{perseverance of effort} = \alpha + \beta_1 \cdot \text{grade} + \beta_2 \cdot \text{GPA} + \beta_3 \cdot X_1 + \beta_4 \cdot X_2 + \beta_5 \cdot X_3 + \varepsilon \quad (2)$$

$$\text{consistency of interests} = \alpha + \beta_1 \cdot \text{grade} + \beta_2 \cdot \text{GPA} + \beta_3 \cdot X_1 + \beta_4 \cdot X_2 + \beta_5 \cdot X_3 + \varepsilon \quad (3)$$

Where  $X_1$  represented students' belief in grit,  $X_2$  represented exposure to teaching activities, and  $X_3$  represented students' perceived benefits from extra-curricular activities. Table 4 shows the results.

Students' belief in grit had significantly positive contribution to grit ( $\beta_3=0.177$ ,  $p=0.045$ ) and perseverance of effort ( $\beta_3=0.243$ ,  $p=0.009$ ). Also, belief in grit positively contributed to consistency of interests ( $\beta_3=0.108$ ,  $p>0.1$ ). This demonstrated the importance of student's belief in grit. In other words, the undergraduates who believe more in grit were grittier.

Exposure to teaching activities positively contributed to grit, perseverance of effort and consistency of interests ( $\beta_4=0.124$ ,  $0.190$ ,  $0.062$ ) respectively. The contributions of exposure to well-designed teaching activities to grit and perseverance of effort were significant. In other words, the undergraduates who were exposed to more well-designed teaching activities tended to be more perseverant especially for long term goals.

Students' perceived benefits from extra-curricular activities showed a different pattern. Students' perceived benefits from extra-curricular activities significantly and negatively contributed to consistency of interests ( $\beta_5=-0.211$ ,  $p=0.054$ ), but positively contributed to perseverance of effort ( $\beta_5=0.069$ ). This suggested that the students who thought they got more benefits from extra-curricular were more likely to persist when confronted with setbacks, but were less likely to persist in a long term goal.

GPA had no significant contributions to grit, perseverance of effort and consistency of interests. In addition, GPA negatively contributed to grit ( $\beta_2=-0.006$ ). It meant that the students with higher GPAs were not grittier than others.

<sup>3</sup> Note: \*\*\* Correlation is significant at the 0.01 level (2-tailed),  $p<0.01$ .

\*\* Correlation is significant at the 0.05 level (2-tailed),  $p<0.05$ .

Table 4 Linear Regression Predicting Grit, Perseverance of Effort and Consistency of Interests with College Activities<sup>4</sup>

Independent variables	grit	perseverance of effort	consistency of interests
(Constant)	2.104***	1.430***	2.783***
grade	0.092**	0.019	0.163***
GPA	-0.006	0.059	-0.072
belief in grit	0.177**	0.243***	0.108
exposure to well-designed teaching activities	0.124*	0.190**	0.062
perceived benefits from extra-curricular activities	-0.070	0.069	-0.211*
R Square	0.098	0.219	0.129
Adjusted R Square	0.057	0.183	0.089

## Discussion

Numerous studies have demonstrated the important role of grit on students' lives. However, little is known how to foster a student's grit. The present study tried to contribute to this area. The study explored the relations among different factors (grit, students' belief in grit, exposure to teaching activities, perceived benefits from extra-curricular activities), and tried to predict students' grit using linear regression analysis. Undergraduate students in a college located in Hong Kong were randomly selected. The Grit Scale developed by Duckworth et al (2007) was adapted and the other scales used in this study were self-developed to measure students' belief in grit, exposure to teaching activities and perceived benefits from extra-curricular activities. The reliabilities of the measurements used in this study were demonstrated to be reliable within an acceptable range.

Correlation analysis and regression analysis were conducted. The results suggested that students' belief in grit were important. The students who believed in perseverance and had more passions for long term goals were grittier. Well-designed teaching activities were also important. The college students who more often were arranged with diverse learning activities and who often made plans during learning process were grittier. As for students' perceived benefits from extra-curricular activities, the students who thought they got more benefits from extra-curricular activities were less consistent in interests. In other words, the students who participated in different kinds of extra-curricular activities usually had not a consistent interest, and were more likely to change interests in a short time. On the contrary, the students who have more consistent interests were grittier, but they considered they did not get so many benefits from extra-curricular activities in college.

Another interesting finding was that the students with higher GPAs were not grittier than the other students. This result was different from that of Duckworth et al (2007). Duckworth et al (2007) found that grit was positively associated with GPAs, but negatively related with students' SAT scores. Nevertheless, this result also indicated that smartness could not guarantee grittiness. This was also similar to the findings of Heckman & Rubinstein (2001) and Heckman & Kautz (2012) which found that standardized tests did not capture students' non-cognitive skills. All these findings suggested that better cognitive skills did not ensure better non-cognitive skills. Non-cognitive skills deserve more specific attentions in schooling. Teachers should encourage

<sup>4</sup> Note: \*\*\* Correlation is significant at the 0.01 level (2-tailed),  $p < 0.01$ .

\*\* Correlation is significant at the 0.05 level (2-tailed),  $p < 0.05$ .

\* Correlation is significant at the 0.1 level (2-tailed),  $p < 0.1$ .

students to believe in the power of grit, and stimulate students to practice making plans and to persist until things were accomplished.

There are several limitations for this study. Firstly, Correlation is not equal to causal effects. The dataset used in this study does not allow us to do causal interpretations. The correlation findings faced the challenge of the inverse causal relationship. Secondly, no cross-college data was collected. Causal analysis could be investigated in the further research.



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