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Physics vs Mathematics teacher candidates' grit trait level: A case study of Universitas Negeri Semarang undergraduate students

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Abstract. The success of college students is traditionally predicted by a standard assessment of academic, cognitive ability. However, there is much evidence that their success is strongly influenced by non-cognitive academic ability, one of which is a grit trait level. This study aims to provide an overview of physics and mathematics student teacher candidates' grit trait level at the Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang (UNNES) who are taking Introductory Physics courses. This research is descriptive research with survey and relational model approach. The samples that participated in this study were 91 students consisting of 49 undergraduate students on physics education program and 42 students from mathematics education program. The grit trait level consists of two dimensions: "consistency of interest" and "perseverance of effort." Grit trait data was obtained using a Short Grit (S-Grit) scale instrument that has been translated into Indonesian and has been tested for its validity and internal consistency. The results showed that student teacher candidates' grit trait was at a moderate level (3.28). In the dimension of consistency is at a moderate level (2.88), while the dimension of perseverance is at a high degree (3.68). Also, there was a significant difference in the students' grit trait level by gender factors. Female students tend to have a higher grit trait level than male students. However, there is no significant difference in students' grit trait level from Physics Education and Mathematics Education.

1. Introduction

In recent years, discussions on the topic of character education are warmly discussed throughout Indonesia. Educators strive to think, try and implement various models of character education for students at various levels of education. This is intended to make the character of Indonesia's young generation stronger, and in the future, the Indonesian nation will become more prosperous.

The success of college students is traditionally predicted by a standard assessment of cognitive academic ability. In America, only 10% of students do not complete their bachelor's degrees by leaving their tertiary education prematurely due to their poor academic performance [1]. However, there is much evidence that their success is strongly influenced by non-cognitive academic ability, one of which is a grit trait level [2,3].

Grit is defined as a person's trait-level perseverance and passion for long-term goals [4]. Grit is a personal character that is shown through behavior to maintain perseverance and enthusiasm in achieving the expected long-term goals. Each has a different level of grit, and this is because grit is part of the individual personality traits that determine how individuals interact in diverse environments [5]. Individuals with a high degree of grit can succeed in achieving their life goals so that they can achieve success. The success is marked by an individual achievement of the dream that they aspire to [6].

Grit has two first-order factors, termed "perseverance of effort" and "consistency of interest" [2,4]. Perseverance is defined as a continued effort to do or achieve something despite difficulties, failure, or opposition. One of the first-order latent factor, termed perseverance of effort, represented participants' reported tendency to sustain the time and energy necessary for accomplishing long-term tasks even in the face of distractions. Perseverance of efforts is interpreted as a formidable effort from someone in trying to achieve a goal and the ability of an individual to survive in a certain duration of time to maintain their work. Perseverance in an effort is shown through the behavior of individuals who are active in working hard, surviving in the face of challenges and being able to hold fast to their choices [4,7,8].

The second first-order factors, termed consistency of interest, is how consistent an individual's business is towards a goal. This second factor focuses on interest over a long period. This means that an individual chooses important things in his life such as setting goals to be achieved and staying consistent with them for a long period. Consistency can be seen from the individual interests and goals that are not easily changed, not easily distracted by other ideas/interests/ goals and remain focused on the initial goals that have been made. Individuals do not easily deviate from one interest towards another interest, and individuals remain focused and consistent to work on things that are of interest to them initially [4,6,9].

Good quality teachers are one of the important success factors in educational processes. A teacher needs to have a good personality, especially grit trait. In various literature, it has been seen that there is a relationship between intelligence and academic success [4,5,9]. For example, when we observe a student to find out the relationship between intelligence and academic success, it is found that students with higher intelligence levels are more successful in their academic lives than students with lower levels of intelligence [10]. When students want to specialize in new fields of knowledge or develop new problem-solving strategies, they face short-term difficulties, or their courage is stopped.

Therefore, it is important to examine the grit-trait level of prospective physics and mathematics teacher students at the Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang (UNNES) and identify the significance of differences according to their gender, age, and origin of the study program. This study aims to provide an overview of physics and mathematics student teacher candidates' grit trait level at the Faculty of Mathematics and Natural Sciences (FMNS), Universitas Negeri Semarang (UNNES) who are taking Introductory Physics courses.

2. Methods

This study is to define physics and mathematics student teacher candidates' grit trait level who are studying at the 1st and 2nd year. This research is descriptive research with survey and relational model approach. A survey model is a research approach that aims to describe the real situation [11]. Grit trait level of the prospective teacher students is indicated by the average grit score achieved by respondents. Grit trait level of students compared according to gender factors and study program. Therefore, this research is also a relational study. Grit trait levels are grouped into 5 levels namely Very High (4.20-5.00), High (3.40-4.19), Medium (2.60-3.39), Low (1.80-2.59), and Very Low (1.00-1.79).

The samples that participated in this study were 91 students consisting of 49 undergraduate teacher candidates students on physics education program and 42 students from mathematics education program. The grit trait level consists of two dimensions: "consistency of interest" and "perseverance of

effort." Grit trait level data was obtained using a Short Grit (S-Grit) scale instrument that has been translated into Indonesian and has been tested for its validity and internal consistency.

Descriptive statistics (frequency, mean, and standard deviation) and nonparametric statistics are used in data analysis. Data have been processed with GNU PSPP statistical software of 0.10.2 version. We used the Mann-Whitney-U test and the Kruskal-Wallis test (nonparametric). The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed.

3. Results and Discussion

Based on the results of the S-Grit scale, the physics and mathematics student teacher candidates' grit trait level at the Faculty of Mathematics and Natural Sciences, UNNES as summarized in Table 1.

Table 1. Descriptive statistics for the student teacher candidates' grit trait level

Item	M	SD	N
The Consistency to Interest	2.88	0.79	
C1 - I often set a goal but later choose to pursue a different one.	3.26	1.11	91
C2 - I have been obsessed with a certain idea or project for a short time but later lost interest.	2.80	1.17	91
C3 - I have difficulty maintaining my focus on projects that take more than a few months to complete.	2.78	1.01	91
C4 - New ideas and projects sometimes distract me from previous ones.	2.68	0.96	91
The Perseverance of Effort	3.68	0.62	
P1 - I finish whatever I begin.	3.62	0.84	91
P2 - Setbacks don't discourage me.	3.91	0.97	91
P3 - I am diligent.	3.45	0.86	91
P4 - I am a hard worker.	3.76	0.82	91
Total	3.28	0.52	

Note: P= Perseverance, C= Consistency

As shown in Table 1, the Item P2 "Setbacks don't discourage me" has obtained the highest score with the average of 3.91 (high) and the lowest score on the item "New ideas and projects sometimes distract me from previous ones" with a mean of 2.68 (medium). The student teacher candidates' grit trait level according to the study program and the gender of the respondents is indicated by the average grit score as shown in Table 2. Overall, teacher candidate students at FMNS UNNES have a moderate level of grit (3.28). On the dimension of consistency, students have a moderate consistency level (2.88), while the perseverance dimension is at a high degree (3.68). Teacher candidate students from Physics Education programs tend to have slightly lower grit level (3.26 <3.31) compared to students from Mathematics Education programs.

Table 2. Average grit trait level according to program and gender of respondent

Program	Gender	N	Mean C	Mean P	Mean Grit
Physics Education	male	12	3.06	3.27	3.17
	female	37	2.99	3.59	3.29
	subtotal	49	3.01	3.51	3.26
Math. Education	male	11	2.32	3.68	3.00
	female	31	2.89	3.96	3.42
	subtotal	42	2.74	3.89	3.31
Total		91	2.88	3.68	3.28

Note: P= Perseverance; C=Consistency

In general, physics teacher candidate students have a higher average consistency score (3.01> 2.74) compared to mathematics teacher candidate students. Based on the average grit score, female students tend to have a higher grit trait level (3.35) than male students (3.09), both in the dimensions of perseverance and consistency. The students' grit trait level, in general, will increase with age (Table 3), except for 20 years old students. As shown in Table 3, students with 19 years old have higher grit scores than those aged 18 years old.

Table 3. Average grit trait level according to the age of respondent

Age	N	Mean C	Mean P	Mean Grit
16	1	1.50	3.25	2.38
18	41	2.77	3.84	3.30
19	38	3.03	3.60	3.32
20	10	2.85	3.45	3.15
21	1	3.50	3.50	3.50

Note: P= Perseverance; C=Consistency

Based on the results of the Mann-Whitney U-test (Table 4), the differences grit trait level of students according to sex factors obtained a significance value of 0.016 ($p < 0.05$). This has shown that there is a significant difference in the teacher candidate students' grit trait level according to gender. Female students tend to have a higher grit trait level than male students. This finding is in line with the results of Lee [12], but different from the results obtained previously, that there is no difference in the degree of grit according to sex factors [5,13].

Table 4. Mann-Whitney U-test result of students' grit trait level according to gender

Gender	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
Male	23	34.59	795.50		
Female	68	49.86	3390.50		
Total	91			519.50	0.016*

However, on the dimensions of consistency and perseverance dimensions, based on the Mann-Whitney U ranking differential test, did not show significant differences. On the dimensions of

consistency, a significance value of 0.178 (p> 0.05) and a perseverance dimension of 0.098 were obtained (p> 0.05).

Table 5. Mann-Whitney U-test result of students' grit trait level according to the study program of respondent

Program	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)
Physics Ed.	49	44.37	2174.00		
Math. Ed.	42	47.90	2012.00		
Total	91			949.00	0.523

N= number of respondents

As shown in Table 5, students' grit trait level is according to the study program (Physics and Mathematics Education), there is no significant differences between physics teacher candidate students and mathematics teacher candidate students. The significance value obtained at 0.523 (p> 0.05). Students from Physics Education programs tend to have the same level of grit trail compared to Mathematics Education programs. Based on the Mann-Whitney U test that obtained a significance value of 0.272 (p> 0.05), there is no significant difference in the students' consistency level both from Physics Education and Mathematics Education program, but a significance value of 0.005 (p <0.05) obtained from test result which means that there is a significant difference in the level of perseverance between physics teacher candidate students and mathematics teacher candidate students. The perseverance level of Mathematics teacher candidate students is higher than Physics Education students.

4. Conclusion

Student teacher candidates of Physics and Mathematics' grit trait was at a moderate level (3.28). In the dimension of consistency is at a moderate level (2.88), while the dimension of perseverance is at a high degree (3.68). Also, there was a significant difference in the students' grit trait level by gender factors. Female students tend to have a higher grit trait level than male students. However, there is no significant difference in students' grit trait level from Physics Education and Mathematics Education.

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