



## Adaptation of The Triarchic Model of Grit Scale and Perceived Academic Underachievement Scale into Turkish

Kayhan BOZGÜN<sup>1</sup>, Fatih CAN<sup>2</sup>, Kemal BAYTEMİR<sup>3</sup>

<sup>1</sup> Faculty of Education, Amasya University, Amasya, Turkey  0000-0001-9239-2547

<sup>2</sup> Faculty of Education, Amasya University, Amasya, Turkey  0000-0002-9593-2382

<sup>3</sup> Faculty of Education, Gazi University, Konya, Turkey  0000-0002-7865-4325

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### ABSTRACT

This study aimed to adapt the Triarchic Model of Grit Scale (TMGS) and Perceived Academic Underachievement Scale (PAUS) to a Turkish state university context and provide evidence of its validity.. The relationships between the scales were also examined. The data of this study was obtained from three different study groups consisting of college students attending a state university located in the Middle Black Sea Region of Turkey. The psychometric properties of the PAUS were examined with the first study group, the psychometric properties of the TMGS were examined with the second study group, and the relationships between both scales and their relations to academic self-efficacy were examined with the third study group. Exploratory Factor Analysis, Confirmatory Factor Analysis, and Pearson's product-moment correlation coefficient were used to analyze data. Results showed that both scales have sufficient validity and reliability. Furthermore, there was a negative relationship between grit and perceived underachievement, a positive relationship between grit and academic self-efficacy, and a negative relationship between perceived underachievement and academic self-efficacy. These findings suggest that adapted scales are valid and reliable measurement tools that can be used to determine perceived academic underachievement and grit levels among adults and teacher candidates.

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Keywords:

Perceived academic underachievement, grit, academic self-efficacy, validity and reliability.

### 1. Introduction

Academic success is always important to get into good universities both in Turkey and in the world or for a good career. The academic success of students has an important role in determining whether they will continue their school or career (Bacanlı, 2012; Emiroğlu, Murat & Bindak, 2011). Considering the factors effective in perceiving oneself as academically successful or being successful, Bandura (1994) stated that the nature of learning has shown that one's self-efficacy beliefs have a significant impact on academic achievement. One's self-perception of themselves as successful or unsuccessful plays an important role in starting and completing tasks. According to Peker et al. (2012), individuals' happiness and self-confidence increase when they are academically successful; however, they feel sad and disappointed when they fail. It can be argued that this sadness and disappointment state may cause individuals to perceive themselves as academically underachieving.

Underachievement is not just a situation experienced by students when they don't study to complete a task but also emerges with the lack of belief in completing a task or with a feeling of weariness, exhaustion, and

<sup>1</sup>Corresponding author's address: Amasya University, Faculty of Education, Amasya /Turkey

e-mail: [kayhanbozgun@gmail.com](mailto:kayhanbozgun@gmail.com)

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tiredness for certain reasons (Balkis et al., 2011; Çapulcuoğlu & Gündüz, 2013). This does not imply that one's perceived underachievement is due to their incapacity to finish a task, but rather that they do not feel prepared to complete a task and believe that their performance is insufficient, despite the fact that they know they can. This relates to a person's impression of himself as a low achiever in school. Academic underachievement is a barrier to success, and in its most broad meaning, it is a perception that an individual's accomplishment is below their recognized potential, or that they perform below their capacity. Perceived academic underachievement emerges when one perceives their academic success regarding a course or all courses they took as poor (Snyder & Adelson, 2017). The concepts of perceived success (Yaşar et al., 2014) and perceived academic underachievement (Snyder & Adelson, 2017) are associated with the completion of the challenging tasks or responsibilities faced by an individual, and studies have shown that these concepts play a decisive role in one's self-efficacy, motivation, burnout, performance, and attitude towards a course (Balkis et al., 2011; Çapulcuoğlu & Gündüz, 2013; Duckworth et al., 2007; Duckworth & Quinn, 2009; Jiang et al., 2019; Kahraman & Sungur, 2016; Kutsal, 2009; Snyder & Adelson, 2017; Strayhorn, 2013; Yaşar et al., 2014; Yılmaz et al., 2007). One of the distinguishing features of successful and unsuccessful individuals is the grit. While some studies claim there is a relationship between grit and achievement (Jiang et al., 2019; Strayhorn, 2013; Tang et al., 2021), others claim there isn't (MacCann & Roberts, 2010), some are contradictory (Wolter & Hussain, 2015), and others claim the relationship is reciprocal (Wolter & Hussain, 2015). (Duckworth et al., 2007; Duckworth & Quinn, 2009). In their study with elementary school pupils, Wolter and Hussain (2015) identified a relationship between grit and success in the initial analysis; further analyses did not detect this relationship. While MacCann and Roberts (2010) determined in their study that there is no relationship between grit and success; Strayhorn (2013) found that grittier individuals show higher achievement. Although there are studies that do not find a relationship between grit and success, theoretically, grit appears as a personality trait that plays a role in perception and tendency to be successful (Wolter & Hussain, 2015). In this regard, as grit increases, perceived achievement increases; and as perceived achievement increases, grit increases.

Grit plays an important role in one's life in being success-oriented and achieving success (Duckworth et al., 2007; Duckworth & Quinn, 2009; Rojas et al., 2012). Many reports indicated that grit is related to academic performance (Christopoulou, et al., 2018; Pate et al., 2017). Furthermore, grit is an important factor in achieving success and progressing towards goals and it also helps get rid of negative emotions such as hopelessness (Özhan & Boyacı, 2018). Although grit is sometimes used to mean concepts of determination and persistence, they are not the same (Duckworth et al., 2007; Shechtman et al., 2013). Because while grit is a cognitive process that comprises beliefs in achieving success, determination and persistence refer to enduring difficulties faced while pursuing success. In this regard, a determination is a cognitive and emotional dimension of grit (Sarıçam et al., 2016); grit refers to a non-cognitive process of one's continued striving for challenging long-term goals with passion and persistence (Christopoulou et al., 2018; Pate et al., 2017). A literature survey on the term 'grit' revealed that the terms determination and persistence are also used to mean grit. However, using the term grit in psycho-educational applications is considered more appropriate (Ekinçi & Hamarta, 2020a).

Grit is defined as the efforts made to overcome challenges while doing a task (Duckworth et al., 2007). Grit can also be defined as determination and a strong willingness to achieve goals and success. In this sense, grit requires being ready to face challenging efforts while fighting with difficulties and maintaining effort and interest accordingly. From this point of view, grit is an important indicator of success (Duckworth et al., 2007; Duckworth & Quinn, 2009). Grit also receives attention as an effective factor in educational processes. Since education is the process of changing and developing one's own thoughts and behaviors with their own interests, efforts, and experiences, effort plays an important role in achieving the intended success. In this regard, the effort put forward to achieve success emerges with an individual's grit (Ekinçi & Hamarta, 2020b). Therefore, grit is an important factor for displaying effort and effective in achieving success (SRI International, 2018). So, it can be argued that effort is an important factor affecting grit. In this sense, grit has a psychological aspect and includes the motivational dimension of self-regulation in achieving goals. Thus, grit accompanied by effort, persistence, and determination is an important factor for overcoming challenges faced while achieving academic success (Sağkal et al., 2020).

There are many studies examining the relationship with different variables in the literature on grit. In the study of Ekinçi and Hamarta (2020), one of these studies related to the subject, the effect of a psycho-education program developed to increase the levels of grit and motivational determination of secondary school students.

The authors found that the grit psycho-education program yielded a significant increase in the secondary school students' grit and motivational determination levels in the experimental group. In a similar study, (Sarıçam et al., 2016) a significant correlation was found between grit and motivational determination. In another study conducted by Özhan and Boyacı (2018), the authors found a negative correlation between grit and psychological symptoms which consists of depression, anxiety, and stress; the authors stated that programs to strengthen grit can be used in the prevention of psychological symptoms. In addition to studies mentioned above, it was determined that grit (Rojas et al., 2012) and academic achievement (Yılmaz, et al., 2007) were related to self-efficacy. In line with this result, the relationship between two variables and self-efficacy was examined in this study.

Self-efficacy belief a variable related to perceived academic underachievement and grit, is an indicator of one's determination to achieve a task or course, such as motivation and belief in personal success (Yılmaz et al., 2007). It is known that self-efficacy is important for starting a task with grit and emotional responses to a task (Bandura, 1986, 1997). Many studies highlighted that grit in students is associated with self-efficacy (Britner & Pajares, 2006; Rojas et al., 2012). Accordingly, it can be argued that students or adults with high self-efficacy beliefs may have grit for starting and/or completing tasks. Failure of performance is one's beliefs about what might happen when one fails. Failure of performance also explains one's belief in fear of failure. While this fear, especially on hardworking individuals, has a motivating effect, in some individuals it causes a feeling of doing nothing, loss of motivation, and an inability to reflect on their potential for that task (Kahraman & Sungur, 2016). This underachievement leads to burnout and thus affects attitude towards a task. In this sense, Alkan (2009) pointed out that students with a positive attitude towards the math course are more successful. Burnout levels increase as an individual fails, and this situation is accompanied by a decrease in self-efficacy (Maslach et al., 2001). Külekçi (2011) examined the relationship between students' self-efficacy beliefs and perceived academic success and found that students with lower self-efficacy beliefs perceive themselves as unsuccessful. Çapulcuoğlu and Gündüz (2013) stated that students with high perceived academic success had lower levels of burnout and higher self-efficacy. According to another study, high-school students who perceived their academic success as moderate suffer more from burnout than those who perceived their academic success as high (Kutsal, 2009). Considering the perceived academic success, Balkıs et al. (2011) emphasized that burnout may lead to low motivation for completing a course assignment. The authors suggested low levels of self-efficacy or environmental factors as reasons.

Although studies on self-efficacy are available in the Turkish literature, no conceptual and assessment studies exist on perceived academic success and only a limited number of scales (Bozgün & Başgöl, 2018; Sağkal et al., 2020; Sarıçam et al., 2016) are presented for grit. To fill this gap, reliable and valid measurement tools are needed on perceived academic underachievement among adults (Snyder & Adelson, 2017) and for multidimensional evaluation of students' levels of grit due to the increased interest in success factors except for cognitive ones in recent years (Christopoulou et al., 2018). A review of the literature revealed that some measurement tools exist, such as the Academic Self-efficacy Scale (Yılmaz et al., 2007), the Performance Failure Appraisal Inventory (Kahraman & Sungur, 2016), and the mathematics attitude scale (Yaşar et al., 2014); however, no measurement tool exists that directly evaluates perceived academic underachievement.. A sub-scale of the mathematics attitude scale developed by Yaşar et al. (2014) is about perceived academic success. The items of that sub-scale are similar to the items of the scale adapted in the current study. Some of the measurement tools for grit available in the Turkish literature are the Short Grit Scale adapted by Sarıçam et al. (2016), the Academic Grit Scale for secondary and high school students adapted by Sağkal et al. (2020), Academic Grit Scale for primary and secondary school students adapted by Bozgün and Başgöl (2018).

As indicated by the above studies, grit and perceived academic underachievement of students play an important role in achieving academic success. Using the Turkish versions of the Triarchic Model Grit Scale and the Perceived Academic Underachievement Scale will help to make a general judgment about Turkish students' academic success. When the relevant literature is examined, it is seen that there is a reciprocal relationship between grit and perceived academic success. For this reason, examining a theoretical relationship between different samples in this study will provide a broader perspective on the subject. Such reasons give importance to this study from different aspects. Since success is an important phenomenon in having a profession and taking high grades in Turkey, students' and individuals' perception of themselves as successful enables them to be more successful and determined. The studies mentioned above generally show that as grit

increases, perceived achievement; As perceived achievement increases, so will grit. In addition, since it is stated in social learning theory that there is a reciprocal relationship between self-efficacy and performance (Bandura, 1986), it is considered important to examine the relationship between perseverance, perceived academic success and self-efficacy. This study adapts the perceived academic underachievement scale (PAUS), which measures the feeling that a student's accomplishments fall below perceived capability and is associated with adults' academic self-efficacy (Snyder & Adelson, 2017), as well as the Triarchic Model of Grit Scale (TMGS), which is effective in achieving success in Turkish (Datu et al., 2017).. Also, the relationships between academic self-efficacy, which has a critical role in students' academic success, and grit, and perceived academic underachievement were also examined.

**2. Methodology**

**2.1. Research Model**

This section provides information about the study group, data collection tools, scale adaptation process, and data analysis. A correlational survey model was also used to examine the relationships between variables (Fraenkel et al., 2012).

**2.2. Research Sample**

Three different studies were conducted in this research. The data for this study was obtained from three different study groups consisting of college students studying at a university located in the Middle Black Sea Region during the spring and fall semesters. The sample was selected using the convenience sampling strategy. In the study groups of this research, female students took place much more than male students. This is because the students in the education faculties for which data are collected are distributed in these ratios. The data for the PAUS was obtained from the first study group and TMGS data is from the second study group. To examine the relationships between scale scores and academic self-efficacy, the data obtained from the third study group was used. Descriptive statistics of the study groups are given in Table 1.

**Table 1.** Descriptive Statistics of the Study Groups

Variables	Categories	Study 1	Study 2	Study 3
Gender	Male	30	56	58
	Female	122	117	197
Age	Age range	18-21	18-30	18-31
	Mean	19.81	20.92	20.71
	Sd	.67	1.98	1.82
	Range	3	12	13
Education year	1	-	45	64
	2	81	30	61
	3	71	51	73
	4	-	47	57
Department	Pre-school Teacher Education	26	31	94
	Elementary Mathematics Teacher Education	39	11	16
	Science Teacher Education	-	55	-
	Turkish Language Education	35	-	145
	Social Studies Teacher Education	28	13	-
	Primary Teacher Education	40	63	-
	Psychological counseling and guidance	24	-	-
Total Number of Students	<i>n</i>	152	173	255

Statistics regarding students' demographic characteristics are presented in Table 1. This data was collected with Personal Information Form which is placed above the data collection form. Data for this study were gathered from three different study groups, classes, and departments in each application. Because the mean age of these three groups was close to each other (19.81 for the first group, 20.92 for the second group, and 20.71 for the third group) and all of the students in the sample were university students, data were collected from different grade levels using convenient sampling. Kline (2016) suggests a sample-size to parameter ratio of 20:1 or at least 10:1 for the factor analysis.2.3. Data Collection Tools

Perceived Academic Underachievement Scale (PAUS) was developed by Snyder and Adelson (2017) to measure perceived academic underachievement among adults aged 18 and over regarding a course or overall courses. The validity of the scale was examined by Exploratory Factor Analysis (EFA) using data from 184 college students. The EFA results showed that item-factor loadings varied between .74 and .90 and 65.90% of the total variance was explained. EFA indicated that the one-factor model of scale with 6 items can be used as a valid measurement tool according to the variance explained by item-factor loadings. Confirmatory Factor Analysis (CFA) was conducted with a different study group and the one-factor model of the scale was confirmed, and goodness-of-indexes were found to be excellent (CFI: .99; TLI: .98; SRMR: .02). This measurement tool is a 5-point Likert-type scale with grades; 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. The score that can be obtained from the scale varies between 6 and 30. While lower scores indicate that one perceives no or low academic underachievement, higher scores indicate that one perceives themselves as academically unsuccessful. The second item of the scale was reverse coded. For internal consistency analysis, Cronbach's alpha for the original scale was calculated as 0.91. While this scale can be used for a course (e.g., perceived academic underachievement for mathematics course) it can be applied to obtain information about one's overall success.

Triarchic Model Of Grit Scale (TMGS) was developed by Datu et al. (2017) to evaluate grit levels in adults and college students. Following intense attention on grit studies, three-factor grit measurement tools were tested in the literature. Construct validity of the scale was examined by EFA using data obtained from 350 college students. In EFA results, item-factor loadings were above 0.30 and explained 57.63% of the total variance. According to the variance explained by factor loadings, EFA indicated that the three-factor model of the 10-item scale can be used as a valid measurement tool. Confirmatory Factor Analysis (CFA) was conducted with a different study group and the three-factor model of the scale was confirmed and model-fit values were found to be acceptable, good, and excellent (CFI: .94; TLI: .938; RMSEA: .051). TMGS consists of *perseverance of effort*, *consistency of interests*, and *adaptability to new situations* sub-scales. According to the reliability tests conducted with three different study groups, Cronbach's alpha coefficients of *perseverance of effort*, *consistency of interests*, and *adaptability to new situations* sub-scales were varied from .60 to .84, .75 to .84, and .88, respectively. In the current study, Cronbach's alpha and McDonald's omega coefficients for internal consistency of the sub-scales were calculated as .71, .7, and .92, respectively. The scale items have 5-point Likert-type responses from 1 = strongly disagree to 5 = strongly agree. While the highest score that can be obtained from the scale is 100, the lowest score is 10. Higher scores indicate higher levels of grit.

Academic Self-Efficacy Scale was developed by Jerusalem and Schwarzer (1981) to measure college students' academic self-efficacy regarding academic learning was adapted into Turkish by Yılmaz et al. (2007). The scale's construct validity was examined with EFA using the data obtained from 672 college students. According to the analysis results, Kaiser-Meyer-Olkin (KMO) value of .83; and Bartlett test  $\chi^2= 1230.09$  were found to be significant. Item-factor loadings varied from .50 to .83 and explained 45% of the total variance. The EFA results showed that the one-factor model of the seven-item scale is a valid measurement tool according to the variance explained by factor loadings. The seventh item of the scale was reverse-coded. A 4-point Likert-type grading was used for responses (1-does not correspond at all, 2-corresponds a little, 3- corresponds moderately, 4-corresponds exactly). While the highest score that can be obtained from the scale is 28, the lowest score is 7. Lower scores indicate lower academic self-efficacy belief, and higher scores indicate higher academic self-efficacy. For internal consistency, while the Cronbach's alpha coefficient of the original scale was calculated as .79, in our study, it was calculated as .87.

#### 2.4. Adaptation Procedure

Since this paper is about scale adaptation, scale adaptation steps are followed for both scales (DeVellis, 2017). Prior to the adaptation of the PAUS and TMGS into Turkish, permissions were received from the developers. Three educational science experts with high English translation proficiency were assisted during the adaptation process. After determining the most appropriate expressions by the researchers, back translations were performed into the original language (English) (DeVellis, 2017). Following the translation process of the scales, two field experts in the field of Guidance and Psychological counseling were asked to review the translated scales in terms of conceptual, semantic, and theoretical integrity. The scales were then finalized based on the expert opinions and evaluations. To prevent any mistakes and to obtain semantic integrity, a pilot implementation study was conducted with 15 teacher candidates. The original version of the TMGS is a

5-point Likert-type scale that measures the level of participation from 1 = not like me at all and 5 = completely like me.

### 2.5. Data Analysis

The data were obtained from volunteer participants face-to-face in a classroom. The completion of the survey took approximately 10 minutes. SPSS 22.0 and LISREL 8.8 software packages were used for the validity and reliability assessment of the scales. To test the construct validity of the three-factor model of TMGS and the one-factor model of PAUS, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed using different datasets. CFA is an analysis technique used to confirm a theoretical structure (Hair et al., 2014). It is known that According to (Hooper et al., 2008; Hu & Bentler, 1999; Kline, 2016; Tabachnick & Fidell, 2014), goodness-of-fit indexes, CFI, IFI, NFI, GFI, and AGFI below .95 are acceptable; .95 and above indicate perfect fit. Similarly, RMSEA and SRMR indexes .05 and below perfect; above .05 indicate a good fit. To examine relationships between scale scores, Pearson's Product-Moment Correlation Coefficients were evaluated and the assessment of internal consistency was done through Cronbach's alpha and McDonald's omega coefficients and item analysis.

### 2.6. Ethical

Ethical Committee Approval is required by applying to Amasya University Social Sciences Ethical Committee in the present study. Ethical Committee Approval's information is presented below:

- Date of decision: 02.04.2021
- The number of the approval document: E-30640013-108.01-13219

## 3. Findings

### 3.1. Validity and Reliability of PAUS

#### 3.1.1. Construct validity

To assess the construct validity of the PAUS, firstly, EFA was performed with 255 data to examine whether the scale consisted of similar factors as in its original forms. Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity test results were examined to examine the suitability of the data structure for factorization and whether the collected data represents the universe. Table 2 shows the factors under which the items were collected and the total differences that can be explained by the items' factor loading values.

**Table 2.** EFA Results for PAUS

Items	Factor loadings
1	.827
2	.796
3	.790
4	.770
5	.715
6	.615
Total varianced	%57.07
Kaiser-Meyer value	.83
Bartlett sphericity test	( $\chi^2/sd = 618.91/15; p < .01$ )

N= 255

As seen in Table 2, as a result of the EFA analysis of the one-dimensional PAUS, the KMO value was found to be high, and the Bartlett test results were found to be significant. The fact that the KMO value is greater than .80 and the Bartlett sphericity test is significant indicates that factor analysis can be performed on the data (Hair et al., 2014). Six items of the scale were collected in a single factor, and the item factor load values took values between .61 and .83. It was observed that the total explained variance of the scale was around 57%. For a scale to be usable, it is known that it must explain at least 60% of the variance (Hair et al., 2014). Another analysis, the Scree-Plot test, checked the factor structure. As a result, it was observed that the single-factor structure of the PAUS was also confirmed in this graph. Scree plot test graphics are given in Figure 1.

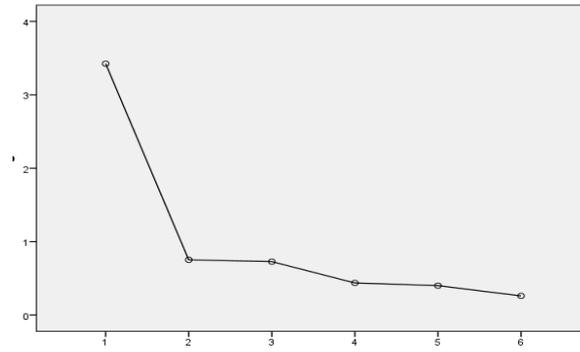


Figure 1. Scree-plot Test for PAUS

CFA was performed for six items included in the original scale using the data obtained from 152 teacher candidates. The fit indices for PAUS are presented in Table 3 and the results of CFA for PAUS are given in Figure 2.

Table 3. CFA Results for PAUS

Goodness-of-fit indexes	Index values
$\chi^2$	15.85
df	9
$\chi^2/df$	1.76
p	.069
RMSEA	.076
CFI	.98
IFI	.98
NFI	.96
RMR	.048
GFI	.96
AGFI	.91

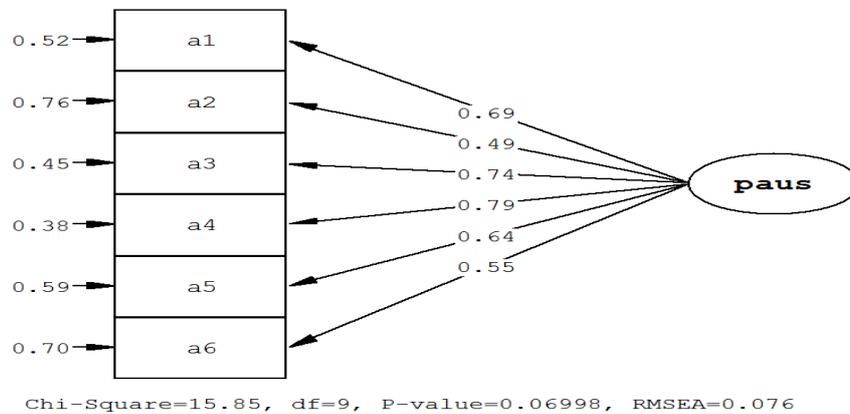


Figure 2. CFA Results for PAUS

As seen in Figure 2, item-factor loadings varied from .49 to .79, and t-values varied from 5.48 to 9.94 and were found to be significant. Furthermore, the AGFI index value indicated an acceptable fit, but all other indexes indicated a perfect fit. Consequently, it was decided that the Turkish version of the PAUS has construct validity.

### 3.1.2. Reliability

For reliability evaluation, Cronbach’s alpha and McDonald’s omega coefficients were calculated to assess the internal consistency of the PAUS, and Cronbach’s alpha and McDonald’s omega coefficients were found to be .80. According to a widely accepted rule, a Cronbach’s alpha coefficient above .70 indicates scale can be used as a reliable measurement tool (Çokluk et al., 2016). For the second reliability evaluation, items were analyzed.

In this regard, corrected item-total correlations for 6 items were examined and the obtained results are given in Table 4.

**Table 4.** PAUS Reliability Analysis Findings

No	Items	Item total correlations	Cronbach's alpha ( $\alpha$ )	McDonald's Omega ( $\Omega$ )
1	I am performing below my capability in course.	.56		
2	I am achieving to the maximum of my capability in course.*	.42		
3	To be honest, I feel that I am underachieving in course.	.61		
4	I am performing below my ability in course.	.64	.80	.80
5	I could perform much better in course than I am currently performing.	.59		
6	My achievement in course does not reflect how well I am capable of achieving in that course.	.52		

\* This item is reverse-coded.

As seen in Table 4, corrected item-total correlations for PAUS varied between .42 and .64. In reliability assessment, item-total correlations higher than .30 indicates scale has a high distinctiveness (Büyüköztürk, 2012). Based on the high corrected item-total correlation values and Cronbach's alpha and McDonald's omega coefficients calculated in the current study showed that PAUS is a reliable measurement tool.

### 3.2. Validity and Reliability of TMGS

#### 3.2.1. Construct validity

For the assessment of the construct validity of TMGS, firstly EFA was performed with 255 data to examine whether the scale consisted of similar factors as in its original forms. Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity test results were examined to examine the suitability of the data structure for factorization and whether the collected data represents the universe. Table 5 shows the factors under which the items were collected and the total differences that can be explained by the items' factor loading values.

**Table 5.** EFA Results for TMGS

Items	1 <sup>st</sup> Factor Perseverance of effort	2 <sup>nd</sup> Factor Consistency of interests	3 <sup>rd</sup> Factor Adaptability to new situations
1	.832		
2	.772		
3	.828		
4		.864	
5		.860	
6		.752	
7			.763
8			.836
9			.754
10			.710
Total varianced	%57.07		
Kaiser-Meyer value	.83		
Bartlett sphericity test	$(\chi^2/sd = 618.91/15; p < .01)$		

N= 255

As seen in Table 5, the KMO value was found to be high, and the Bartlett test results were found to be significant for the TMGS. The fact that the KMO value is greater than .80 and the Bartlett sphericity test is significant indicates that factor analysis can be performed on the data (Hair et al., 2014). The first three items of the TMGS are in the *perseverance of effort* sub-scale, the next three items are in the *consistency of interest* sub-scale, and the last four items are in the *adaptability to new situations* sub-scale. It is seen that factor loading values have high values between .71 and .86. It was determined that the total explained variance of the scale was approximately 71%. Another analysis, the Scree-Plot test, checked the factor structure. As a result, it was found that the one-factor structure of the TGMS scale was also confirmed in this graph. The graphs of the scree plot test are shown in Figure 3. Confirmatory Factor analysis (CFA) was performed for 10 items and three sub-

scales of the original scale using the data obtained from 173 teacher candidates. The obtained goodness-of-fit indexes of TMGS are presented in Table 6.

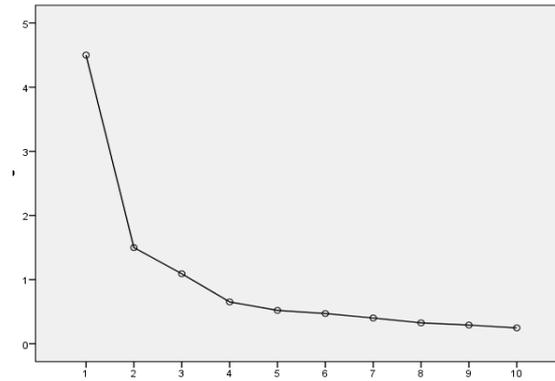


Figure 3. Scree-plot Test for TMGS

Table 6. CFA Results for TMGS

Goodness-of-fit indexes	Index values
$\chi^2$	54.36
<i>df</i>	32
$\chi^2/df$	1.70
<i>p</i>	.008
RMSEA	.063
CFI	.98
IFI	.98
NFI	.96
SRMR	.036
GFI	.94
AGFI	.90

As seen in Table 6, according to the CFA results, whereas AGFI and GFI indexes indicate acceptable model fit, other indexes indicate perfect fit. CFA results are also given in Figure 4.

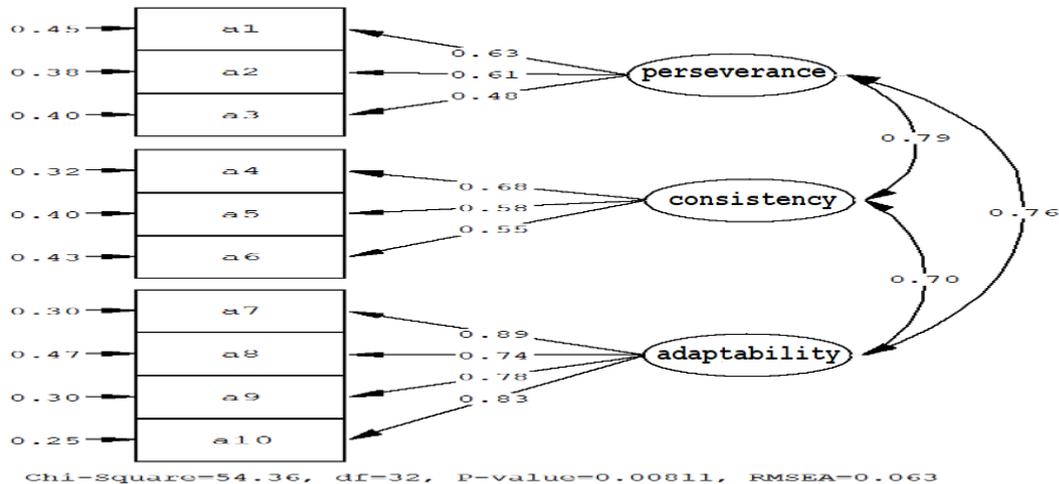


Figure 4. CFA Results for TMGS

According to the model results shown in Figure 4, factor loadings varied from .48 to .89; t-values from 7.90 to 13.69 and found to be significant. Consequently, based on these results and model-fit-index values, the 10-item TMGS scale with the *perseverance of effort*, *consistency of interests*, and *adaptability to new situations* sub-scales was found to be have construct validity.

### 3.2.2. Reliability

For reliability evaluation of the TMGS, Cronbach’s alpha and McDonald’s omega coefficients were calculated. McDonald’s omega is another internal reliability coefficient (McDonald, 1970). Kline (2016) stated that a

Cronbach’s alpha coefficient greater than .90 is perfect; .80-.90 is good, and .70-.80 is acceptable. Items were analyzed as another reliability assessment. Accordingly, corrected item-total correlations were examined for 10 items and three sub-scales of the scale, and the obtained results are presented in Table 7.

**Table 7.** *TMGS Reliability Analysis Findings*

Sub-scale	No	Items	Item total correlations	Cronbach’s alpha ( $\alpha$ )	McDonald’s Omega ( $\Omega$ )
Perseverance of effort	1	I am a hard worker.	.60	.70	.71
	2	I finish whatever I begin.	.60		
	3	I am diligent.	.56		
Consistency of interests	4	New ideas and projects sometimes distract me from previous ones.	.59	.74	.74
	5	I have been obsessed with a certain idea or project for a short time but later lost interest.	.54		
	6	I often set a goal but later choose to pursue a different one.	.50		
Adaptability to new situations	7	I appreciate new opportunities that come into my life.	.77	.92	.92
	8	Changing plans or strategies is important to achieve my long-term goals in life.	.69		
	9	Changes in my life motivate me to work harder.	.74		
	10	I am able to cope with the changing circumstances in life.	.80		
Total			-	.90	.90

As seen in Table 7, Cronbach’s alpha coefficients for sub-scales of perseverance of effort, consistency of interests, and adaptability to situations and the full scale were calculated as .70, .74, .92, and .90, respectively. McDonald’s omega coefficients were also calculated, and only a minor difference was obtained for the sub-scale of perseverance of effort as .71. The corrected item-total correlations of the scale varied from .54 to .80. In reliability analysis, corrected item-total correlations greater than .30 indicate that scale has a high distinctiveness (Büyüköztürk, 2012). Based on the calculated corrected item-total correlations and high internal consistency coefficients, TMGS is considered a reliable measurement tool.

**3.3. Relationships Between Grit, Perceived Academic Underachievement, and Academic Self-Efficacy**

To examine the relationships between grit, perceived academic underachievement, and academic self-efficacy, Pearson correlation coefficients were calculated using the data of the third study group. Also, to evaluate the criterion validity of the scales and examine the relationships between variables, the relations of PAUS and TMGS to the Academic Self-efficacy Scale were also examined. Since grit and perceived academic success is theoretically associated with academic self-efficacy, Academic Self-efficacy Scale was used to determine criterion-related validity. The obtained findings are presented in Table 8.

**Table 8.** *Correlations between Variables*

	1	2	3
1. Grit	-		
2. Perceived academic underachievement	-.20**	-	
3. Academic Self-efficacy	.48**	-.21**	-
	$\bar{X}$	37.12	20.49
	$Sd$	6.80	5.26
			23.35
			5.18

Note: N = 255; p < .01\*\*.

As shown in Table 8, the relationships between grit, perceived academic underachievement, and academic self-efficacy were examined with Pearson correlation analysis. The analyzes were performed using total scores and descriptive statistics were also considered. According to the analysis results, a significant negative low correlation was found between total scores of PAUS and Academic Self-efficacy Scale ( $r = -.21, p < .01$ ) and a significant negative low correlation between total scores of TMGS and PAUS ( $r = -.20, p < .01$ ). Furthermore, a significant positive moderate correlation was found between grit and academic self-efficacy ( $r = .48, p < .01$ ).

#### 4. Conclusion and Discussion

In this study, the PAUS developed by Snyder and Adelson (2017) to measure the perceived academic achievement level of adults and the TMGS developed by Datu et al. (2017) to assess the level of grit in adults and college students are adapted into Turkish. The validity and reliability of the adapted scales were also examined. The data used during the adaptation processes were obtained from college students. The items of the adapted scales were evaluated by field experts, language specialists, and experts in the field of assessment and evaluation. The data used in this study were obtained from three different study groups, and findings were discussed under three different studies.

The construct validity of the PAUS was examined with CFA. CFA results showed that t-values of the scale are significant, factor loadings, and goodness-of-fit indexes indicate perfect fit. The one-factor structure of the 6-items Turkish version of the PAUS was confirmed. Regarding the internal consistency measurements, Cronbach's alpha and McDonald's omega coefficients were calculated as .80. High corrected item-total correlations indicate that PAUS is a reliable measurement tool with items that can distinguish individuals. Finally, based on the obtained results, the Turkish version of PAUS is considered a valid and reliable measurement tool that can be used in Turkish samples.

The validity and reliability tests of the TMGS were carried out. The construct validity of the TMGS was examined using CFA. According to the CFA results, t-values were found to be significant, factor loadings and goodness-of-fit indexes indicate a perfect fit. The three-factor model of the Turkish version consisting of 10 items was confirmed. For internal consistency calculations, both Cronbach's alpha and McDonald's omega coefficients were found to be .90. High corrected item-total correlations indicate that TMGS is a reliable measurement tool with items that can distinguish individuals. Finally, according to the obtained results, the Turkish version of the TMGS is accepted as a valid and reliable measurement tool that can be used in Turkish samples.

In the last analysis, the concepts' relationships were examined through the PAUS, TMGS, and Academic Self-efficacy Scale developed by Yılmaz et al. (2007). The significant negative low correlation found between PAUS and Academic Self-efficacy Scale scores indicates that academic self-efficacy, which is the belief about success, is related to perceived underachievement. Furthermore, we determined a significant positive moderate correlation between grit and academic self-efficacy. This finding highlights the importance of one's self-efficacy beliefs for grit. Based on the determined relationships, it can be argued that the scales have criterion validity in addition to construct validity. According to course grades, Strayhorn (2013) examined the relationship between grit and success and determined that students with more determination are more successful. According to these findings, it can be thought that grit plays a role in the student's perceived successful. However, when perceived academic underachievement is high, it can be said that the individual will be less gritter. This study revealed that it is necessary to increase their grit, as students' perception of themselves as more successful enables the development of their academic studies and taking higher course grades. At the same time, as stated in the literature, grit and perceived achievement reciprocally determine each other (Duckworth et al., 2007; Duckworth & Quinn, 2009). Therefore, if the student perceives himself as unsuccessful, his grit may decrease. On the contrary, as the student's grit decreases, he may perceive himself as unsuccessful. In both cases, the student's academic success may be negatively affected.

Finally, it was determined that the Turkish version of the PAUS measures the same one-factor 6-item structure as the original scale. Also, the Turkish version of the TMGS measures the same 3-factor 10-item structure as the original scale. Both PAUS and TMGS are considered valid and reliable measurement tools to evaluate perceived academic underachievement among adults and measure grit levels in adults and college students, respectively. Since students' perceived academic underachievement levels also affect their grit, the PAUS scale can be used in researchs on this subject. While this scale can be used for a single course, it will also be effective in determining the general academic underachievement level. While grit is theoretically two-dimensional in some studies (Sarıçam et al., 2016); there are also studies in which grit is used as one-dimensional (Rojas et al., 2012). Turkish version of TMGS scale, which is adapted with this study, will be able to reveal new studies and findings related to the structure of grit in the literature.

The literature search revealed that there is no scale to measure perceived academic underachievement and multidimensional grit in students, so PAUS and TMGS can make valuable contributions to the literature. Moreover, the correlations found between self-efficacy belief, which is important for success, grit, and perceived success, are important for further studies (Snyder & Adelson, 2017). It is stated that as one's perceived academic underachievement decreases and grit level increases, self-efficacy beliefs increase and thus, burnout can be prevented (Çapulcuoğlu & Gündüz, 2013; Kutsal, 2009).

## 5. Recommendations

This study has some limitations. The data was obtained from college students aged 18 and above attending a state university located in the Middle Black Sea region. The scales may be applied to students studying in universities in other regions or those in non-formal education courses. The use of the scales in different age groups can be examined by performing validity and reliability measurements with high-school students. Further studies may examine the impact of parental academic support on students' grit levels, perceived academic underachievement, and academic self-efficacy. The mediating role of academic underachievement and grit level in the relationship between academic self-efficacy and academic success can be examined. In addition, the relationships between perceived academic underachievement and certain variables such as self-efficacy beliefs, academic optimism, test anxiety, intrinsic motivation, grit, and academic procrastination can be examined. In addition, PAUS can be used to obtain information about a specific course. Quantitative studies can be conducted that examine the relationship between perceived academic underachievement and grit, as well as qualitative studies that solicit thoughts and views on variables that may increase grit or cause perceived academic underachievement.

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### Appendix 1. Turkish Version of Perceived Academic Underachievement Scale

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1. Derslerde kapasitemin altında performans gösteriyorum.
  2. Derslerde kapasitemi en üst düzeyde kullanıyorum. \*
  3. Dürüst olmak gerekirse, derslerde olması gerekenin altında başarı gösterdiğimi düşünüyorum.
  4. Derslerde yeteneğimin altında performans gösteriyorum.
  5. Derslerde daha çok gayret gösterebilirdim.
  6. Derslerdeki başarıım, o derslerde ne kadar yeterli olduğumu yansıtmıyor.
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\* Bu madde ters kodlanmaktadır.

### Appendix 2. Turkish Version of Triarchic Model Of Grit Scale

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1. Çalışkanım.
  2. Başladığım işi her ne olursa olsun bitiririm.
  3. Gayretliyim.
  4. Yeni düşündüğüm planlar, önceki planlarımdan beni vazgeçirir.
  5. Kısa süre belli bir plana bağlı kaldıktan sonra vazgeçerim.
  6. Genellikle belirlediğim hedeften daha sonra vazgeçerim.
  7. Karşıma çıkan yeni fırsatlar benim için önemlidir.
  8. Plan ve stratejilerde değişikliğe gitmek uzun dönemli hedeflerime ulaşmamda önemlidir.
  9. Yaşamımdaki değişiklikler beni daha çok çalışmaya motive eder.
  10. Yaşamda karşılaştığım değişikliklerin üstesinden gelebilirim.
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