Erzincan Üniversitesi Eğitim Fakültesi Dergisi
Erzincan University Journal of Education Faculty
*2025 Cilt 27 Sayı 2 (249-256) https://doi.org/10.17556/erziefd.1585281*
Araştırma Makalesi / Research Article

# Academic Grit Scale: Adaptation, Validity, and Reliability Study for Middle and High School Students*

# Akademik Azim Ölçeği: Ortaokul ve Lise Öğrencilerinde Uyarlama, Geçerlik ve Güvenirlik Çalışması

**Ahmet Çağlar Özdoğan[1] İlhan Yalçın[2]**

[1] Doç.Dr., İzmir Demokrasi Üniversitesi, Eğitim Fakültesi, İzmir, Türkiye
[2] Prof.Dr., Ankara Üniversitesi, Eğitim Bilimleri Fakültesi, Ankara, Türkiye

**Makale Bilgileri**

*Geliş Tarihi (Received Date)*

14.11.2024

*Kabul Tarihi (Accepted Date)*

05.05.2025

***Sorumlu Yazar***

Ahmet Çağlar Özdoğan

İzmir Demokrasi Üniversitesi, Eğitim Fakültesi, İzmir

ahmetcaglar.ozdogan@idu.edu.tr

***Abstract:*** The aim of this study is to adapt the Academic Grit Scale, developed by Clark and Malecki (2019), into Turkish. Validity and reliability studies for the adaptation process were conducted on two different groups. The first participant group consisted of middle school students, while the second participant group included high school students. Middle and high school students from various schools were selected using an appropriate sampling method and included in the study sample. Confirmatory Factor Analysis (CFA) was applied to test whether the construct was confirmed within these two distinct sample groups. According to the CFA results, the scale's 10-item, single-factor structure demonstrated good fit indices. Internal consistency coefficients of the Academic Grit Scale were calculated using Cronbach's alpha reliability coefficient. Accordingly, the internal consistency coefficient was determined to be .89 for middle school students, .92 for high school students, and .92 for the entire sample. After determining the internal consistency coefficients, the test-retest reliability of the scale was also calculated. Test-retest reliability was found to be .82 for the middle school group, .86 for the high school group, and .85 for the entire sample. As a result of the study, the Academic Grit Scale was found to be a valid and reliable measurement tool for middle and high school students.

**Keywords:** Grit, academic grit, validity, reliability, middle school-high school students

***Öz:*** Bu çalışmanın amacı Clark ve Malecki (2019) tarafından geliştirilen Akademik Azim Ölçeğinin Türkçeye uyarlama çalışmasının yapılmasıdır. Ölçeğin uyarlama sürecindeki geçerlik ve güvenirlik çalışmaları iki farklı grup üzerinde gerçekleştirilmiştir. Birinci katılımcı grup ortaokul öğrencilerinden, ikinci katılımcı grup ise lise öğrencilerinden oluşmaktadır. Bu kapsamda çeşitli okullardan ortaokul ve lise öğrencileri uygun örnekleme yöntemine göre belirlenerek araştırmanın örneklemine dâhil edilmiştir. İki farklı örneklem grubu içerisinde ilgili yapının doğrulanıp doğrulanmadığını test etmek için Doğrulayıcı Faktör Analizi uygulanmıştır. Yapılan DFA sonuçlarına göre ölçeğin 10 madde ve tek boyuttan oluşan yapının iyi uyum değerlerine sahip olduğu görülmektedir. Akademik Azim Ölçeği'nin iç tutarlık katsayıları Cronbach Alpha güvenirlik katsayısı ile hesaplanmıştır. Buna göre; ölçeğin ortaokul öğrencileri için iç tutarlık katsayıları .89, lise öğrencileri için .92 ve bu iki gruptan oluşan örneklemin tamamı için ise .92 olarak belirlenmiştir. İç tutarlık katsayılarının belirlenmesinin ardından ölçeğin test tekrar test güvenirliği de hesaplanmıştır. Buna göre ortaokul öğrencilerinden oluşan grubun test tekrar test güvenirliği .82, lise öğrencilerinden oluşan grubun test tekrar test güvenirliği .86 ve bu iki gruptan oluşan örneklemin tamamı için ise .85 olarak belirlenmiştir. Araştırma sonucunda Akademik Azim Ölçeğinin ortaokul ve lise öğrencilerinde geçerli ve güvenilir bir ölçme aracı olduğu belirlenmiştir.

**Anahtar Kelimeler:** Kariyer, kariyer gelişim programı, proaktivite, proaktif kariyer davranışları

Özdoğan, A. Ç.& Yalçın, İ. (2025). Academic grit scale: Adaptation, validity, and reliability study for middle and high school students. *Erzincan Üniversity Journal of Education Faculty,* 27(2), 249-256. https://doi.org/10.17556/erziefd.1585281

## Introduction

Grit is generally used to describe the ability to cope with challenges in order to achieve goals (Stoffel & Cain, 2018). More specifically, grit can be defined as the passion and persistence to reach long-term goals (Duckworth et al., 2007). Grit is a broad dimension with two primary hierarchical components: effort and consistency of interest. Effort involves carefully exerting oneself and overcoming obstacles while pursuing challenging goals, while consistency of interest emphasizes maintaining focus on these goals with sustained enthusiasm (Duckworth & Quinn, 2009). As these definitions suggest, grit is a general concept, which is why the literature often examines it in relation to specific domains (Maravillas, 2016).

Although the concept of grit is applied across various contexts, one of the most common settings is the school environment (Prince, 2015). Thus, grit is considered crucial for students' academic success and is regarded as an area well-suited for school-based interventions. Within the challenging academic context, school-based initiatives that focus on fostering academic grit have garnered attention in recent years to enhance students' motivation and commitment (Clark & Malecki, 2019; Kirchgasler, 2018; Maravillas, 2016).

Studies on student achievement often focus on students' cognitive abilities and the effort they put forth (Ishitani & DesJardins, 2002). Research shows that grit, independent of IQ, is associated with both academic and professional success (Duckworth & Quinn, 2009). In this context, the concept that emerges from grit and reflects its impact within school settings is known as academic grit. Academic grit is defined as the continuous effort and desire a student demonstrates toward achieving academic goals, specifically within the academic domain (De Vellis, 2003).

Focusing on students' levels of academic grit in school is considered important to increase their effort during challenging processes and to prepare them for these challenges (Clark & Malecki, 2019). Thus, the value or importance that an individual places on a field influences their motivation to exert effort in that field, which significantly impacts whether the outcomes are positive or negative (Osborne & Jones, 2011).

* This study was produced from a part of the doctoral thesis of Assoc. Prof. Dr. Ahmet Çağlar Özdoğan under the supervision of Prof. Dr. Ilhan Yalçın.

School-based studies on student achievement reveal a positive relationship between academic grit and academic success. A meta-analysis study demonstrated that the two dimensions of grit—effort and consistency of interest—are positively related to academic success. Additionally, the study found that these dimensions vary by grade level, with effort being the most influential variable on academic success compared to general ability level and consistency of interest (Lam & Zhou, 2019). Studies exploring academic success and grit consistently indicate a positive correlation between the two (Banupriya & Rajan, 2019; Bennett et al., 2020; Mason, 2018). However, another study found no significant relationship between grit and academic success, although it did conclude that individuals with higher levels of grit are more likely to pursue graduate studies (Palisoc et al., 2017).

In addition to academic achievement, research also identifies a positive relationship between grit and well-being. A meta-analysis (Credé et al., 2017) found a positive association between grit and life satisfaction. Another study reported a positive correlation between grit and well-being, showing that grit is a significant predictor of well-being (Spoeskes, 2018). Research by Vainio and Daunkantaite (2016) explored the relationship between grit and both dimensions of well-being—subjective and psychological—and found that authenticity and emotional consistency serve as mediating factors between psychological well-being and grit. Additional studies further confirm the meaningful link between grit and well-being (Barete et al., 2019; Datu et al., 2016). Furthermore, research highlights a connection between adolescents' grit levels and the quality of their friendships (Eskreis-Winkler et al., 2014; Lan, 2020).

When the overall results are evaluated, grit is seen to have a significantly positive relationship with academic achievement and general psychological health. It is noticeable that studies specifically focusing on academic grit, which describes the academic dimension of grit, are relatively limited. There is a clear need for further research on academic grit and its determinants, especially for students likely to encounter various challenges in their academic life at school. Although studies on academic grit in Türkiye have increased in recent years, limitations are still evident. Adapting scales within the scope of this field could contribute to the literature. Based on this, the present study aims to adapt the Academic Grit Scale, developed by Clark and Malecki (2019), into Turkish and test its psychometric properties in adolescent students.

## Method

### Participants

The validity and reliability studies for the Academic Grit Scale were conducted with two different groups. The first group consisted of middle school students, while the second group included high school students. Middle and high school students from various schools affiliated with the Ministry of National Education were selected for the study sample using an appropriate sampling method. The ages of the middle school students in the study ranged from 10 to 15 years (M=11.74, SD=0.67), with a total of 303 participants, of whom 165 were female (54%) and 141 were male (46%). According to Kline (2011), the adequate sample size is typically considered to be 5 to 10 participants per item. Accordingly, the sample size is considered sufficient. The distribution of middle school students is presented in Table 1.

**Table 1**. Data on the study group (middle school)

| Grade | Gender | *N* | *%* |
|---|---|---|---|
| 5th grade | Girls | 21 | 6.9 |
| | Boys | 31 | 10.1 |
| 6th grade | Girls | 53 | 17.3 |
| | Boys | 33 | 10.8 |
| 7th grade | Girls | 50 | 16.3 |
| | Boys | 51 | 16.7 |
| 8th grade | Girls | 41 | 13.4 |
| | Boys | 26 | 8.5 |
| Total | | 306 | 100 |

The validity and reliability studies of the Academic Grit Scale for the high school group included students aged between 14 and 18 (M=16.02, SD=0.86), comprising a total of 207 students, with 124 females (60%) and 83 males (40%). The distribution of high school students is shown in Table 2.

**Table 2.** Data on the study group (high school)

| Grade | Gender | *N* | *%* |
|---|---|---|---|
| 9th grade | Girls | 25 | 12.1 |
| | Boys | 15 | 7.2 |
| 10th grade | Girls | 25 | 12.1 |
| | Boys | 20 | 9.7 |
| 11th grade | Girls | 29 | 14.0 |
| | Boys | 15 | 6.8 |
| 12th grade | Girls | 45 | 21.7 |
| | Boys | 34 | 16.4 |
| Total | | 207 | 100 |

### Data Collection Instruments

In this study, the Demographic Information Form developed by the researchers, along with School Satisfaction, Life Satisfaction, and Academic Achievement scores, was used as data collection tool.

### Academic Grit Scale

The Academic Grit Scale was developed by Clark and Malecki (2019) to measure the effort and grit students exhibit in achieving success in school and their general career paths. The scale consists of 10 items and a single-factor structure in a 5-point Likert format. High scores on the scale indicate higher levels of academic grit among students. In the development study of the Academic Grit Scale, criterion-related validity was examined using variables such as academic achievement, life satisfaction, school satisfaction, and general grit level. The results indicated that the scale possesses criterion-related validity. The original form of the scale has a Cronbach's alpha reliability coefficient of .92. For the adaptation process, the researchers contacted the scale's corresponding author via email and obtained the necessary permissions to begin the adaptation.

### The Comprehensive School Satisfaction Scale

The Comprehensive School Satisfaction Scale for children was developed by Randolph et al. (2009) and adapted into Turkish by Telef (2014). The scale consists of six items and a single factor, rated on a 5-point Likert scale. The scores obtained from the scale range from 6 to 30. High scores on the scale indicate higher levels of school satisfaction as perceived by children. Validity and reliability studies for scale development were conducted on two groups of students from the Netherlands and Finland. As a result of the validity study, it was determined that the scale consisted of a single factor and

that the factor loadings of the items ranged from .78 to .85 for the Dutch sample and from .80 to .89 for the Finnish sample. The internal consistency coefficient (α) was calculated as .92 for the Finnish sample and .90 for the Dutch sample. In the adaptation study of the scale into Turkish, it was found that it explained 65% of the total variance. The Cronbach's alpha internal consistency coefficient was calculated as .89, and the test-retest correlation was found to be .92. In this study, the internal consistency coefficient was determined to be (α) .91.

**Life Satisfaction Scale**

The Life Satisfaction Scale, developed by Diener and colleagues and adapted into Turkish by Köker (1991), consists of 7 items and a single factor on a 5-point Likert scale. The scores obtained from the scale range from 5 to 35. Higher scores indicate higher levels of life satisfaction among individuals. In the adaptation study, the scale was examined in terms of its validity and reliability values. In the validity and reliability study conducted with an adolescent sample, the test-retest reliability coefficient of the scale administered three weeks apart was found to be r = .85, while the item-test correlations ranged from r = .71 to r = .80. The Cronbach's alpha internal consistency coefficient (α) for the scale was determined to be .76 (Köker, 1991). In this study, Cronbach's alpha internal consistency coefficient was determined as (α) .82.

**Procedure**

To make the adaptation process of the Academic Grit Scale into Turkish more systematic, the seven-step scale adaptation process outlined by Sousa and Rojjanasrirat (2011) was followed. In this context, the following steps were followed during the adaptation process of the Academic Grit Scale.

***In the first step,*** each scale was translated from English to Turkish by three individuals: two English language experts and one subject matter expert with a strong command of English***. In the second step,*** these three translations were combined into a single document in a scoring form with 10-point ratings. The translations were then reviewed and scored by three different experts: one subject matter expert with excellent foreign language proficiency and two English language specialists. Items that received 80% or higher agreement were finalized into a single Turkish version of the scale. ***In the third step***, two English language experts who had not seen the original form of the scale translated the finalized Turkish version back into English. ***In the fourth step,*** four experts involved in the translation and back-translation process examined the translated items for semantic discrepancies between the back-translated items and the original form. They concluded that the items were consistent with each other. Subsequently, two Turkish language experts reviewed the Turkish version for linguistic validity and deemed it appropriate. ***In the subsequent steps***, the scale underwent pilot testing (steps 5 and 6). In the final step of the adaptation process, item discrimination, validity, and reliability analyses were conducted. Confirmatory Factor Analysis (CFA) was used to examine the factor structure of the scales, while Cronbach's alpha coefficient was calculated to assess internal consistency. Pearson Product-Moment Correlation Analysis was applied to determine the correlations between the mean and standard deviation values of the scales and their subscales. ***Finally,*** to calculate the scale's stability coefficient, the test-retest method was used. Pearson Product-Moment Correlation Analysis was conducted to calculate the relationship between the scores obtained from two applications administered two weeks apart.

**Data Analysis**

Before conducting Confirmatory Factor Analysis (CFA) on the adapted Short Form of the Academic Grit Scale within the study, the dataset was examined for missing data, outliers, univariate and multivariate normality, singularity, multicollinearity, and linearity (Harrington, 2009).

First, the dataset was checked for missing values, and no missing data were found. Outliers within the dataset can impact parameter estimations, goodness-of-fit indices, and standard errors in Structural Equation Modeling. Therefore, it is essential to examine and report these values prior to analysis (Cheung & Rensvold, 1999). For univariate outlier analysis, it is necessary to transform the scores of the items on the scale into standard scores. According to Tabachnick and Fidell (2013), data with z-scores outside the range of ±3.3 ($p < .001$) may be considered univariate outliers. Mertler and Vannatta (2005), however, suggest that in larger samples (n > 100), this range may be extended to ±4 for normal distribution. Accordingly, item scores were converted to z-scores, and seven observations were found to fall outside the ±3.3 range. Among these, only one observation violated the ±4 threshold, leading to the decision to remove this observation from the dataset.

After the univariate outlier analysis, multivariate outlier analysis was conducted within the framework of Mahalanobis distances ($p < 0.001$). According to Tabachnick and Fidell (2013), the Mahalanobis distance value should be compared with the chi-square table value, which corresponds to the degrees of freedom of the independent variables, and any observations exceeding the critical value should be examined. The analysis revealed that all values were below the critical value of (10) = 29.59. Therefore, the analysis of other assumptions proceeded.

Multicollinearity occurs when the test items on the scale are highly correlated with each other in pairs ($r > .90$), while singularity refers to a correlation coefficient of 1.00 between item pairs (Şencan, 2005). According to Tabachnick and Fidell (2013), high multicollinearity and singularity in factor analysis can pose problems, and such data should be excluded from the dataset. When the correlation coefficients between the items of the Academic Grit Scale were examined, they ranged from .41 to .65, indicating that no issues of multicollinearity or singularity were present initially in the dataset.

Additionally, to investigate multicollinearity among the variables in the dataset, Variance Inflation Factor (VIF), Condition Index (CI), and tolerance values were examined. If the VIF value is less than .10, tolerance values are .10 or above, and the CI value is below .30, it can be concluded that there is no multicollinearity (Hair et al., 1998). For the variables in this study, VIF values ranged from 1.720 to 2.572, and tolerance values ranged from .41 to .58, all of which did not violate the reference values.

To examine the univariate normality assumption, descriptive statistics along with skewness and kurtosis coefficients were utilized. A skewness and kurtosis value within the range of [-1, 1] indicates that the univariate normality assumption is met (Büyüköztürk, 2012). In this context, skewness and kurtosis coefficients were calculated for all items in the dataset. Since the obtained values fall within the reference values (0.234 - 0.789), it is assumed that the univariate normality assumption holds. After examining

univariate normality, the dataset was further analyzed for multivariate outliers. For this purpose, the Mardia's test of multivariate normality was utilized. The results of the Mardia's test indicated that the obtained value for the kurtosis coefficient fell within the reference range of 1.105, and no violations of multivariate normality were identified. Accordingly, since the data met the assumptions of univariate and multivariate normality, the maximum likelihood method was selected as the estimation method (Kline, 1998).

## Findings

Confirmatory Factor Analysis (CFA) was conducted to test whether the relevant construct is confirmed in the two different sample groups. CFA is used in the scale development process to examine the latent structures of a measurement tool. In addition to assessing the representational power of the items, CFA also provides an opportunity to evaluate the relationships between the dimensions of the scale (Stevens, 2009). According to Kline (2011), in CFA, at least four values, including RMSEA, SRMR, Chi-square, and CFI, should be reported to evaluate the model's goodness of fit, and these values should fall within the reference value ranges for the model to be considered a good fit. The main fit indices and their reference ranges (Brown, 2015; Kline, 2011; Tabachnick & Fidell, 2013) are presented in Table 3.

The model goodness-of-fit values obtained for the sample group (middle school, high school, and student groups in general) are presented in Table 4.

**Table 3.** Main fit ındices and reference ranges

| Fit Index | Good Fit | Acceptable Fit |
|---|---|---|
| *χ 2 /sd (Ki-kare / serbestlik derecesi)* | *≤ 3* | *≤ 5* |
| *CFI* | *≥ 0.97* | *≥ 0.95* |
| *TLI* | *≥ 0.95* | *≥ 0.90* |
| *SRMR* | *≤ 0.05* | *≤ 0.10* |
| *RMSEA* | *≤ 0.05* | *≤ 0.08* |

**Table 4.** Model goodness of fit values obtained from variables

| Variables | Model | *χ²* | *df* | *χ²/df* | *CFI* | *TLI* | *SRMR* | *RMSEA* |
|---|---|---|---|---|---|---|---|---|
| Middel School | Single Factor | 79.673 | 35 | 2.28 | 0.97 | 0.96 | 0.03 | 0.65 |
| High School | Single Factor | 62.866 | 35 | 1.80 | 0.98 | 0.97 | 0.03 | 0.62 |
| General | Single Factor | 107.46 | 35 | 3.07 | 0.97 | 0.97 | 0.03 | 0.62 |

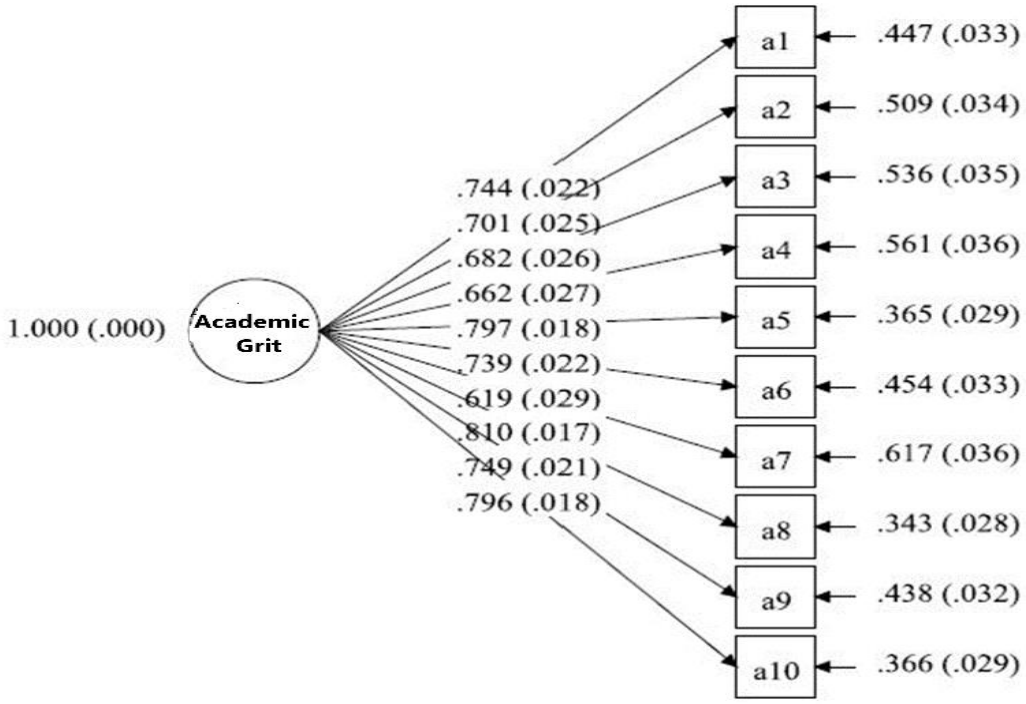


**Figure 1.** Path diagram of confirmatory factor analysis

**Table 5.** t Values obtained from CFA for academic grit scale

| Item Number | *t* | Item Number | *t* |
|---|---|---|---|
| AG1 | 17.09* | AG6 | 16.69* |
| AG2 | 14.27* | AG7 | 10.59* |
| AG3 | 13.23* | AG8 | 23.24* |
| AG4 | 12.36* | AG9 | 17.44* |
| AG5 | 21.72* | AG10 | 21.63* |

*AG: Academic Grit*

**Table 6.** Independent sample t test based on 27 percent lower-upper group difference

| | Extreme Group | *N* | $\bar{x}$ | *ss* | *t* | *sd* | *p* |
|---|---|---|---|---|---|---|---|
| Middle School | Bottom | 84 | 46.07 | 0.84 | -23.711 | 163.835 | .000 |
| | Top | 84 | 49.11 | 0.81 | | | |
| High School | Bottom | 54 | 29.24 | 4.80 | 25.545 | 68.892 | .000 |
| | Top | 54 | 47.17 | 1.88 | | | |
| Total | Bottom | 138 | 32.67 | 4.48 | 40.511 | 154.351 | .000 |
| | Top | 138 | 48.61 | 1.13 | | | |

**Table 7.** Pearson product moment correlation analysis table for criterion validity

| Variables | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. Academic Grit | - | | | |
| 2. School Satisfaction | .63** | - | | |
| 3. Life Satisfaction | .50** | .59** | - | |
| 4. Academic Grade Point Average | .38** | .21** | .23** | - |

***p*<.01, **p*.<.05

The path diagram of the Academic Grit Scale, presented in Figure 1, is shown. According to the results of the CFA, the t-values for all path coefficients between the variables are greater than 2.56, indicating that the level of significance for all items representing their respective factors is at the 0.01 level (Kline, 2011).

When the findings presented in Table 5 are examined, it can be seen that the t-values for the Academic Grit Scale range from 12.36 to 23.24. According to the results, the t-values for the 10 items obtained through CFA are statistically significant at the 0.01 level.

### Findings Regarding the Reliability Studies of the Academic Grit Scale

The internal consistency coefficients of the Academic Grit Scale were calculated using the Cronbach Alpha reliability coefficient. The internal consistency coefficients are as follows: .89 for middle school students, .92 for high school students, and .92 for the entire sample comprising both groups. After determining the internal consistency coefficients, the test-retest reliability of the scale was also calculated. The test-retest reliability was found to be .82 for the middle school group, .86 for the high school group, and .85 for the entire sample comprising both groups.

### Significance of the 27% Upper-Lower Group Difference

The significance of the 27% upper-lower group difference, which is considered an indicator of internal consistency (Şencan, 2005), is also regarded as evidence that the scale items can distinguish between different measurements (Başol, 2012; Şencan, 2005). To assess the discriminative power of the scale items, the significance of the 27% upper-lower group difference was examined. The difference between the groups with high and low school climate scores was analyzed using an independent samples t-test for the middle school, high school, and the full sample group comprising both groups. The analysis results are presented in Table 6.

When Table 6 is examined, it is seen that the difference between the scores of students with low and high Academic Grit Scale scores is significant (*p*<.001). This finding shows that the scale items are discriminative within each group.

### Criterion Validity

Criterion validity refers to the process of comparing scores obtained from a scale with scores obtained from previously developed and accepted scales that were applied to the same study group in order to determine the relationship between them (Weir, 2005). In this context, to test the criterion validity of the Academic Grit Scale, the School Satisfaction Scale developed by Randolph et al. (2009) and adapted by Telef (2014), and the Life Satisfaction Scale developed by Diener et al. (1985) and adapted by Köker (1991) were used as similar tests. Additionally, students' academic grade point averages were used for construct validity. The results of the Pearson Product-Moment Correlation Analysis are presented in Table 7.

When the obtained findings are examined, significant relationships were found between the Academic Grit Scale and the School Satisfaction Scale ($r = .63$, $p < .01$), and the Life Satisfaction Scale ($r = .50$, $p < .01$). Additionally, a significant relationship was found between the Academic Grit Scale and the academic grade point average ($r = .38$, $p < .01$). These results indicate that the scale demonstrates validity with similar constructs.

### Findings Related to Measurement Invariance of Academic Grit Scale

In the study, multiple group confirmatory factor analyses were applied to determine whether the Academic Grit Scale has measurement invariance according to middle and high school. For between-group comparisons, data from the first and second participant groups were combined (middle and high school = 513). In the analyses, configural invariance, in which parameter restrictions were not applied, and metric invariance, in which factor loadings were equal across groups, were examined. The measurement invariance of the Academic Grit Scale according to middle and high school was tested. The results of multiple group confirmatory factor analyses showed that the structural model provided an acceptable fit to the data set; in other words, the Academic Grit Scale had structural invariance with respect to middle and high school: $\chi2$ (70) = 154.823, p < .001, $\chi2$ /sd = 2.212, CFI = .970, TLI = .962, RMSEA = .049 CI [.04, .06]. In addition, it was determined that the values related to the metric model in the analyses were also within acceptable fit limits: $\chi2$ (79) = 159.065, p < .001, $\chi2$ /sd = 1.960, CFI = .973, TLI = .970, RMSEA = .043 CI [.03, .06]. The ΔCFI = .003 (ΔCFI < .01) and ΔRMSEA = .006 (ΔRMSEA < .015) values obtained in the structural and metric model comparisons showed that the Academic Grit Scale had metric invariance across middle and high school.

**Conclusion, Discussion, and Recommendations**

In this study, the adaptation of the Academic Grit Scale into Turkish was carried out, and its psychometric properties were examined with middle and high school students (ages 10-18). Confirmatory factor analysis results, conducted separately for two participant groups and a combined multiple group, showed good model fit. The results indicated that the Academic Grit Scale retains its one-factor structure, as it does in its original form. This suggests that the scale demonstrates the same structure across similar groups.

As the first step in adapting the Academic Grit Scale, a linguistic equivalence study was conducted. In this process, a two-week interval was used to compare the original version of the scale with its Turkish adaptation. The high correlation values obtained indicate that the original and Turkish versions of the scale are equivalent. Additionally, in terms of model fit, a unidimensional structure was confirmed after the scale's adaptation. The adapted Academic Grit Scale follows a 5-point Likert-type format, consistent with the original, and contains no reverse-coded items. In the confirmatory factor analysis, the fit indices obtained were as follows: for middle school students, $\chi 2/sd = 2.28$, RMSEA = 0.07, SRMR = 0.03, TLI = 0.96, CFI = 0.97; for high school students, $\chi 2/sd = 1.80$, RMSEA = 0.06, SRMR = 0.03, TLI = 0.97, CFI = 0.98; and for the overall sample, $\chi 2/sd = 3.07$, RMSEA = 0.06, SRMR = 0.03, TLI = 0.97, CFI = 0.97. These results indicate that the model fit indices for both middle and high school students fall within the acceptable reference values, confirming that the model's fit is adequate (Hu & Bentler, 1999; Kline, 2011; Tabachnick & Fidell, 2013).

In the criterion validity analysis of the Academic Grit Scale, significant positive relationships were found between the School Satisfaction Scale and the Life Satisfaction Scale. Additionally, a significant relationship was found between the Academic Grit Scale and academic grade point average. Academic grit reflects the effort and grit individuals demonstrate toward their academic goals over an extended period (Postigo et al., 2020). In this sense, grit is an individual trait that keeps a person engaged in a challenging task, rather than a cognitive characteristic (Duckworth, 2016). Research has shown that gritty students tend to have higher levels of success in both academic and non-academic performances and possess greater motivation when searching for meaning in order to reach their goals (Postigo et al., 2020; Terry & Peck, 2020). In addition, a study conducted by Noronha et al. revealed a significant relationship between students' life satisfaction and their levels of grit. Similarly, Williams (2024) found a significant relationship between academic grit and life satisfaction. Research on school satisfaction, another concept addressed in the study, also supports our findings. In a study on the subject, it was determined that there were positive relationships between students' perceived school satisfaction, hope, and academic grit (Peker & Cengiz, 2023). In another study, a significant relationship was found between academic grit and school satisfaction in middle and high school students (Özdoğan, 2023). Therefore, the value or importance an individual places on a field affects how motivated that individual is to make an effort in that field. This is an important factor in whether the results are positive or negative (Osborne & Jones, 2011). These results demonstrate the scale's validity with similar constructs. Furthermore, the findings obtained are consistent with the original results of the scale (Clark & Malecki, 2019).

The reliability study of the Academic Grit Scale was conducted using Cronbach's alpha as the reliability coefficient. Accordingly, the internal consistency coefficients for middle school students were found to be .89, for high school students .92, and for the entire sample consisting of both groups .92. After determining the internal consistency coefficients, the test-retest reliability of the scale was also calculated. The test-retest reliability for the middle school group was found to be .82, for the high school group .86, and for the entire sample consisting of both groups, it was .85. These findings suggest that the adapted Academic Grit Scale is a reliable measurement tool for assessing the relevant construct.

In the study, the measurement invariance of the academic grit scale on middle and high school students was tested. According to the results obtained, the measurement invariance of the academic grit scale on middle and high school students was determined to be significant. According to Flowers et al. (2002), measurement invariance is defined as the situation in which individuals who are at the same level in terms of the psychological trait to be measured but in different subgroups receive the same observed score from the applications made with the same measurement tool. The invariance of measurements emerges as a condition for the significance of this comparison in intergroup comparisons (Cheung & Rensvold, 2000), and this finding shows that it has invariance within both groups. As a result, the obtained finding reveals the measurement invariance of the academic grit scale on middle and high school students.

Additionally, as another indicator of internal consistency, the results were examined for the significance of the 27% upper-lower group difference. The difference between groups with high and low school climate scores was found to be significant in the middle school, high school, and combined sample groups. This finding demonstrates that the scale items are discriminative within both groups. The results of the study indicate that the Academic Grit Scale can be used as a valid and reliable measurement tool to assess students' academic grit levels.

**Conclusion and Recommendations**

A review of the relevant literature reveals that while studies examining students' academic grit levels have increased in recent years, a limitation in the literature remains in this area. In Türkiye, where success evaluation is predominantly exam-focused (Yıldırım & Ergene, 2003), it is believed that the development of students' academic grit levels will positively contribute to their academic achievements and psychological well-being. School-based intervention programs aimed at increasing academic grit have been shown to contribute to students' academic success. Therefore, recommendations for school-based interventions to increase students' grit levels have been gaining popularity recently (Kirchgasler, 2018). In this regard, the adaptation of the Academic Grit Scale into Turkish is thought to be significant for contributing to the relevant literature. This will open the way for further research in Türkiye to identify students' academic success and related variables.

Moreover, conducting a comprehensive study during the adaptation process and utilizing multiple analysis techniques in validity and reliability studies are among the strengths of the current research. On the other hand, there are some limitations in this study, which involves the adaptation of the Academic Grit Scale into Turkish. The first limitation is the participant group used in the adaptation study. This research sample

consists of various middle school and high school students from the central district of the city. Therefore, it is recommended that the study be replicated with a larger and more diverse sample. Another limitation is that the data for this research were collected during the COVID-19 pandemic. Due to the quarantine period and the shift to remote learning, which kept students away from the school environment, it is possible that their grit levels were negatively affected. With the end of the COVID-19 pandemic and the subsequent normalization process, research into academic grit levels will be important for enhancing the scale's measurement capabilities.

**Author Contributions**

This study was produced from a part of the doctoral thesis of Assoc. Prof. Dr. Ahmet Çağlar Özdoğan under the supervision of Prof. Dr. Ilhan Yalçin.

**Ethics Declaration**

This study was conducted with the approval decision taken at the 2022/06 meeting of Ankara University in Social Sciences (Protocol No. 3/55) dated March 30, 2020.

**Conflict of Interest**

There is no conflict of interest for this study.

**References**


Banupriya. V., & Rajan. R. (2019). Grit and academic achievement: Is it related? *International Journal of Indian Psychology*, *7*(2), 679-686. https://www.doi.org/10.25215/0702.081

Barete, L. S., Apag, J., & Bracero, S. (2019). *Grit and subjective well-being: The mediating and moderating role of spirituality*. (Master Thesis), Psychology, Mindanao State Universty. doi: 10.13140/RG.2.2.32676.94081

Başol, G. (2013). *Eğitimde Ölçme ve Değerlendirme*. Ankara: Pegem Akademi.

Bennett, D., McCarty, C., & Carter, S. (2020). The relationship between grit and academic performance in the classroom. *Journal for Economic Educators, 20*, *2*, Retrieved from https://libjournals.mtsu.edu/index.php/jfee/article/view/1900

Brown, T. A. (2015). *Methodology in the social sciences. Confirmatory factor analysis for applied research (2nd Ed.).* The Guilford Press.

Büyüköztürk, Ş. (2012). *Sosyal Bilimler İçin Veri Analizi El Kitabı*. Ankara: Pegem Akademi

Cheung, G. W., & Rensvold, R. B. (1999). Testing factorial invariance across groups: A reconceptualization and proposed new method. *Journal of Management, 25*(1), 1–27. doi: 10.1177/014920639902500101

Clark, K. N., & Malecki, C. K. (2019). Academic grit scale: Psychometric properties and associations with achievement and life satisfaction. *Journal of School Psychology, 72,* 49–66. doi: 10.1016/j.jsp.2018.12.001

Credé, M., Tynan, M. C., & Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *Journal of Personality and Social Psychology, 113*(3), 492–511. doi: 10.1037/pspp0000102

Datu, J. A. D., Valdez, J. P. M., & King, R. B. (2016). Grit counts but consistency does not! Validating the Short Grit Scale in a collectivist setting. *Current Psychology: A Journal for Diverse Perspectives on Diverse Psychological Issues, 35*(1), 121–130. doi: 10.1007/s12144-015-9374-2

De Vellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed., Vol. 26). Thousand Oaks, CA: Sage Publications.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49*(1), 71–75. doi: 10.1207/s15327752jpa4901_13

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). *Journal of Personality Assessment, 91*(2), 166–174. doi: 10.1080/00223890802634290

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Grit and passion for long-term goals. *Journal of Personality and Social Psychology*, *92,* 1087–1101. doi:10.1037/0022-3514.92.6.1087.

Eskreis-Winkler, L., Duckworth, A. L., Shulman, E. P., & Beal, S. (2014). The grit effect: Predicting retention in the military, the workplace, school and marriage. *Frontiers in Psychology, 5*, 36. https://www.doi.org/10.3389/fpsyg.2014.00036

Flowers, C.P., Raju, N.S. & Oshima, T. C. (2002). *A comparison of measurement equivalence methods based on confirmatory factor analysis and item response theory*. Paper presented at the Annual Meeting of the National Council on Measurement in Education, New Orleans.

Hair, J., Anderson, R., Tatham, R. & Black, W. (1998). *Multivariate data analysis*. 5th Edition, Prentice Hall, New Jersey.

Harrington, D. (2009). *Confirmatory factor analysis*. New York: Oxford University Press.

Ishitani, T. T., & DesJardins, S. L. (2002). A longitudinal investigation of dropout from college in the United States. *Journal of College Student Retention: Research, Theory & Practice*, *4*(2), 173–201. doi:10.2190/V4EN-NW42-742Q-2NTL

Kirchgasler, C. (2018). True grit? Making a scientific object and pedagogical tool. *American Educational Research Journal, 55,* 4, 693-720. doi:10.3102/0002831217752244

Kline, R. B. (1998). *Principles and practice of structural equation modeling.* Guilford Press.

Kline, R. B. (2011). *Methodology in the social sciences. Principles and practice of structural equation modeling (3rd ed.).* Guilford Press.

Köker, S. (1991). *Normal ve sorunlu ergenlerin yaşam doyumu düzeylerinin karşılaştırılması.* Yayınlanmamış Yüksek Lisans Tezi, Ankara Üniversitesi, Ankara.

Lam, K. K. L., & Zhou, M. (2019). Examining the relationship between grit and academic achievement within K-12 and higher education: A systematic review. *Psychology in the Schools*, *56*(10), 1654-1686.

Lan, X. (2020). Grit and peer relationships in early adolescence: A person-centered approach. *Journal of Social and Personal Relationships*, *37*(7), 2250–2269. doi:10.1177/0265407520921557

Maravillas, M. A. (2016). Academic grit scale. *SSRN Electronic Journal*, 1-28 doi: 10.2139/ssrn.3559726

Mason, H. D. (2018). Grit and academic performance among first-year university students: A brief report. *Journal of Psychology in Africa, 28*(1), 66–68. doi:10.1080/14330237.2017.1409478

Mertler, C. A. & Vannatta, R. A. (2005) *Advanced and multivariate statistical methods: Practical application and interpretation*. 3rd Edition, Pyrczak, Los Angeles.

Noronha, A.P.P, Dias-Viana, J.L. & Cavallaro, A.P.O. (2024). The influence of grit on life satisfaction of Brazilian undergraduate students: academic adaptation as a mediator. *Fronties Psychology, 15:*1331259. https://www.doi.org/10.3389/fpsyg.2024.1331259

Osborne, J. W., & Jones, B. D. (2011). Identification with academics and motivation to achieve in school: How the structure of the self influences academic outcomes. *Educational Psychology Review, 23*(1), 131-158. https://www.doi.org/10.1007/s10648-011- 9151-1

Özdoğan, A.Ç. (2023). Mediating role of academic grit and subjective vitality in the relationship between school belongingness and school satisfaction among middle school students who migrated after an earthquake. *Journal of Happiness and Health*, *3*(2), 127–138. https://doi.org/10.47602/johah.v3i2.64

Palisoc, A., Matsumoto, R. R., Ho, J., Perry, P. J., Tang, T. T., & Ip, E. J. (2017). Relationship between grit with academic performance and attainment of postgraduate training in pharmacy students. *American Journal of Pharmaceutical Education*, *81*(4), 67. doi:10.5688/ajpe81467

Peker, A., & Cengiz, S. (2023). Academic monitoring and support from teachers and school satisfaction: The sequential mediation effect of hope and academic grit. *Child Indicators Research*, *16*(4), 1553-1579.

Postigo, Á., Cuesta, M., Fernández-Alonso, R., García-Cueto, E., & Muñiz, J. (2020). Temporal stability of grit and school performance in adolescents: A longitudinal perspective. *Psicología Educativa, 27*(1), 77 - 84. https://www.doi.org/10.5093/psed2021a4

Prince, J. P. (2015). University student counseling and mental health in the United States: Trends and challenges. *Mental Health & Prevention*, *3*(1—2). https://www.doi.org/10.1016/j.mhp.2015.03.001

Sousa, V. D., & Rojjanasrirat, W. (2011). Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: A clear and user-friendly guideline. *Journal of Evaluation in Clinical Practice, 17*, 268-274. https://www.doi.org/10.1111/j.1365-2753.2010.01434.x

Spoeskes, J. (2018). *The effect of grit on orientation to well-being, well-being and their relationship.* Behavioural, Department of Psychology, (Master Thesis), University of Twente, Holland. Retrieved from http://purl.utwente.nl/essays/74852

Stoffel, J. M., & Cain, J. (2018). Review of grit and resilience literature within health professions education. *American Journal of Pharmaceutical Education*, *82*(2), 6150. doi:10.5688/ajpe6150

Şencan, H. (2005). *Sosyal ve Davranışsal Ölçümlerde Güvenilirlik ve Geçerlilik (Reliability and Validity in Social and Behavioral Measurements),* Ankara: Seçkin Yayıncılık.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6. ed.) Pearson, Boston

Telef, B. (2014). Turkish Adaptation Study of Overall School Satisfaction Scale for Children/Çocuklar İçin Kapsamlı Okul Doyumu Ölçeği'nin Türkçeye Uyarlama Çalışması. *Eğitimde Kuram ve Uygulama*, *10*(2), 478-490.

Terry, D., & Peck, B. (2020). Academic and clinical performance among nursing students: What's grit go to do with it?. *Nurse Education Today*, *88*, 104371. Advance online publication. doi:10.1016/j.nedt.2020.104371

Vainio, M. M., & Daukantaitė, D. (2016). Grit and different aspects of well-being: Direct and indirect relationships via sense of coherence and authenticity. *Journal of Happiness Studies: An Interdisciplinary Forum on Subjective Well-Being, 17*(5), 2119–2147. https://www.doi.org/10.1007/s10902-015-9688-7

Weir, C. J. (2005). *Language testing and validation*. New York: Palgrave Macmillan.

Williams, J. (2024). *Associations Between Grit, Life Satisfaction, and Academic Outcomes in Elementary and Middle School Students* (Master's thesis, The University of Alabama at Birmingham).

Yıldırım, İ, ve Ergene, T. (2003). Lise Son Sınıf Öğrencilerinin Akademik Başarılarının Yordayıcısı Olarak Sınav Kaygısı, Boyun Eğici Davranışlar ve Sosyal Destek. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 25.* Erişim adresi: https://dergipark.org.tr/tr/pub/hunefd/issue/7813/102587