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# EVALUATION OF THE VALIDITY AND RELIABILITY OF THE TURKISH VERSION OF THE "DARK FUTURE SCALE"

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## Abstract

**Objectives:** Future anxiety is a common mental health issue, especially among young people and medical students, and is influenced by various factors. This study aimed to evaluate the psychometric properties, including the validity and reliability, of the Turkish adaptation of the Dark Future Scale in a sample of intern medical students.

**Materials and Methods:** This study, employing a methodological design, was implemented from June 1 to December 30, 2022, with 301 intern physicians at Ankara Yıldırım Beyazıt University. The validity of the scale was assessed using content and construct validity, convergent and criterion-related validity, along with item-total correlation analysis. The reliability of the scale was evaluated through item-total correlation analysis, internal consistency (Cronbach's alpha), and test-retest reliability.

**Results:** A moderate, positive correlation was observed between the Dark Future Scale and the Depression, Anxiety, and Stress Scale-21, supporting convergent validity. Item-total correlations for the Dark Future Scale ranged from 0.73 to 0.90, with all values statistically significant ($p<0.001$). Goodness-of-fit indices in confirmatory factor analysis showed that the construct validity of the Dark Future Scale was at an acceptable level. The scale showed strong reliability, with item-total correlations ranging from 0.73 to 0.90, a Cronbach's alpha of 0.89, and a test-retest coefficient of 0.94.

**Conclusion:** The results showed that the Dark Future Scale is valid and reliable in medical school students and is an ideal tool to measure future anxiety. The brevity and practicality of the scale make it easy to use in both research and clinical settings.

**Keywords:** Anxiety, medical students, psychometrics, reproducibility of results.

## Introduction

Mental health is one of the basic human needs and can cause serious problems if not maintained. One of the mental health problems that frequently affects society is anxiety.[1] In general, anxiety can be defined as a state of uneasiness or irrational fear of a dangerous situation.[2] Studies have shown that the general level of anxiety increases in both young and elderly people.[3,4] Anxiety disorders in our country have a prevalence of 6-7% and are among the most common psychiatric disorders.[5]

Future anxiety is the feeling of being uneasy about future events and that dangerous changes will occur in the future.[6] Future anxiety is more of a cognitive feature, and individuals are aware of the situation.[7] The basis of future anxiety varies according to people's fears and personal experiences. It is one of the basic elements of personality traits that determine how people react to current events and negative prospects.[6] Future anxiety arises from many reasons, such as natural disasters, terrorism, diseases, socioeconomic situations, and climate crises.[7-9]

The fact that society and the people living in it have a strong fear of the future poses many risks. Fear of the future particularly affects the young population of a society to a great extent. Identifying young people's worries and expectations about the future is an effective way to prepare a better future for them or build a better future for them.[10]

In an international meta-analysis, it was shown that one in three medical students suffers from anxiety problems and that this is more common than in other university students.[11] In a research conducted among medical students in Türkiye, it was shown that half of the students had anxiety problems related to the future and their profession.[12] The COVID-19 pandemic, which has affected the whole world since 2019, has severely affected healthcare workers psychologically. [13] At the same time, violence in healthcare is an important issue that remains on the agenda in our country.[14,15] Both the COVID-19 pandemic and incidents of healthcare violence are thought to seriously increase physicians' anxiety about the future.

In 2017, Zaleski et al. developed 'The Dark Future Scale', which measures anxiety about the future.[7] The primary objective of this research was to rigorously evaluate the validity and reliability of the Turkish adaptation of the Dark Future Scale (DFS) within a population of medical students currently engaged in their internship training. Given the importance of accurately assessing future-related anxiety and concerns in this critical transitional period of medical education, the study aimed to provide comprehensive psychometric evidence supporting the use of the DFS in Turkish clinical and educational settings.

## Materials and Methods

Before utilizing the scale, permission was secured from the original authors through electronic correspondence. Additionally, ethical approval for the study was granted by the relevant Institutional Ethics Committee. Before enrollment, all participants gave their informed consent to participate in the study. The study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki.

*Study population and location*

Our study is a methodological study conducted between June 1 and December 30, 2022, on intern physicians who are studying at Ankara Yıldırım Beyazıt University.

Following the guideline that the sample size should be at least 5 to 10 times the number of items on the scale, the study aimed to recruit an appropriate number of participants and ultimately included 301 individuals.[15] Data were collected from participants via Google Forms. To test the validity and reliability of the scale in the adult age group, an age limit of 18 years was set for participation in the study. Inclusion criteria were that participants were over 18 years old, studying at a university, and agreed to participate in the study.

*Data collection instruments*

In 2017, Zaleski et al. developed the 5-question scale "The Dark Future Scale' to measure perceptions of future anxiety.[7] The Dark Future Scale is a 5-question scale that assesses a negative perspective on the future. Responses are recorded on a 7-point Likert scale with scores from 0 to 6, representing the options: 0 = decidedly false, 1 = false, 2 = somewhat false, 3 = uncertain, 4 = somewhat true, 5 = true, and 6 = decidedly true. The overall score is obtained by adding the item scores, with possible values spanning from 0 to 30. Higher scores indicate an increased tendency toward a negative perception of the future.

The Dark Future Scale was translated from the mother tongue into Turkish according to the proposed standard method.[16,17] It was translated by professionals fluent in both languages. To compare both versions of the questionnaire, it was translated from English to Turkish and then back to English.

The Depression Anxiety and Stress Scale (DASS 21) was developed in 2005 by Henry et al. It consists of 21 items and includes seven questions, each measuring the dimensions of depression, anxiety, and stress. The scale uses a 4-point Likert format designed to measure how often participants encounter specific thoughts, emotions, or behaviors. The answer choices are assigned numerical values as follows: 0 corresponds to "Did not apply to me at all – NEVER," indicating the participant never experienced the described item; 1 stands for "Applied to me somewhat, or some of the time – SOMETIMES," reflecting infrequent occurrences; 2 means

"Applied to me to a significant extent, or much of the time – OFTEN," showing frequent experience; and 3 indicates "Applied to me very much, or nearly all the time – ALMOST ALWAYS" denoting a consistent or near-constant presence of the symptom or behavior.[18] The Turkish adaptation of the scale was performed by Yılmaz et al..[19]

Our questionnaire included questions on gender, age, financial status, and school grade point average, the Dark Future Scale, consisting of 5 questions, and the DASS 21 Scale, consisting of 21 questions.

*Statistical analysis*

The data analysis was carried out using IBM SPSS Statistics software, version 26.0. For continuous variables, central tendency and dispersion were summarized by calculating means and standard deviations. Categorical variables were expressed as counts and percentages to illustrate their distribution within the sample. Statistical analyses were performed with a 95% confidence interval to provide reliable estimates of the population parameters. A p-value threshold of less than 0.05 was applied to determine statistical significance.

*Validity analysis*

For the convergent validity analysis of the equivalence form, Spearman correlation analysis, which is a non-parametric correlation analysis, was used because the scale data were ordinal. For item analysis, item correlation with the total score was used.

For validity analysis, first, the suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) score. Additionally, Bartlett's test was used. Explanatory (EFA) and Confirmatory factor analysis (CFA) were conducted to assess the fit of the model to the observed data and construct validity. To evaluate the model's goodness-of-fit, several fit indices were examined, including the chi-square to degrees of freedom ratio ($\chi^2$/df), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), and the comparative fit index (CFI). These indicators collectively provide a comprehensive assessment of how well the proposed model fits the observed data. Additionally, non-parametric statistical tests were employed to compare group differences and further explore the clinical validity of the scale. Specifically, the Kruskal-Wallis test was used to analyze differences among three or more independent groups, while the Mann-Whitney U test served to compare differences between two groups. These analyses enabled a robust evaluation of the scale's ability to distinguish between clinically relevant subpopulations.

*Reliability analysis*

The reliability of the scale was evaluated by examining the correlations between individual item scores and the total scale score. To assess internal consistency and overall reliability, Cronbach's alpha coefficient was calculated, providing a measure of how consistently the items collectively reflect the underlying construct.

The questionnaire was piloted with a group of 10 participants to test its comprehensibility. After the pilot study, it was applied to 301 participants, and test-retest reliability was assessed by re-applying it to 30 participants selected from these participants at three-week intervals.

## Results

Of the 301 participants, 174 (57.8%) were female, and 127 (42.2%) were male, with a mean age of 24.16±1.69 (min-max 21-37) years. Thirty-five (11.6%), 234 (77.7%), and 32 (10.6%) participants reported that their financial situation was poor, moderate, and good, respectively. The mean value of the DFS was 20.01±7.57 (min-max 0-30). The results are significant and show that the participants with a poor financial situation scored higher on the scale than the participants with moderate and good financial situations, that is, they are more worried about the future (Table 1).

**Table 1.** Distribution of the sociodemographic characteristics of the participants according to the Athe scores obtained from the Dark Future Scale

| | | n (%) | Mean±Sd | Median | Min-Max | p |
|---|---|---|---|---|---|---|
| **Gender** | Female | 174(57.8%) | 20.47±7.05 | 22.0 | 0-30 | 0.410 |
| | Male | 127(42.2%) | 19.38±8.20 | 21.0 | 0-30 | |
| **Financial Situation** | Poor | 35 (11.6%) | 23.88±7.37 | 27.0 | 0-30 | **< 0.001** |
| | Moderate | 234(77.8%) | 19.79±7.20 | 21.0 | 0-30 | |
| | Good | 32(10.6%) | 17.37±8.94 | 19.0 | 0-30 | |
| **Grade Average** | AA | 19(6.3%) | 23.78±5.21 | 25.0 | 14-30 | 0.112 |
| | BA | 119(39.5%) | 20.36±6.79 | 21.0 | 0-30 | |
| | BB | 125(41.5%) | 19.31±8.02 | 21.0 | 0-30 | |
| | CB | 30(9.9%) | 20.76±7.43 | 22.5 | 0-30 | |
| | CC | 8(2.7%) | 14±12.04 | 15.5 | 0-30 | |
| **Country** | Türkiye | 276(91.6%) | 20.62±7.27 | 22.0 | 0-30 | **< 0.001** |
| | Other | 25(8.4%) | 13.28±7.59 | 15.0 | 0-28 | |

*Validity analysis of the DFS*

According to the Kaiser-Meyer-Olkin criterion (KMO) measure of sampling adequacy, the sample size was deemed sufficient for conducting factor analysis. Additionally, the magnitude of the observed correlation coefficients and the corresponding partial correlations indicated suitability for this analysis, with a KMO value of 0.87 reflecting a high degree of sampling adequacy. After Bartlett's test, the universal correlation matrix was found not to be a unit matrix, and the sphericity criterion was met ($p<0.001$).

EFA indicated that the scale had a single-factor structure explaining 71.23% of the total variance, with factor loadings ranging from 0.80 to 0.87. These findings demonstrate that the scale possesses adequate construct validity.

Methods of content validity, convergent validity, item correlation with the total score (material analysis), criterion validity, and construct validity were used to determine the validity of the scale. Content validity was measured using expert opinion. It was directed to 10 experts in the field of scale, and the relationship of each item with the scale structure was examined and verified.

To evaluate the content validity of the scale items, CVI values were calculated for each item. Based on this evaluation, there was no need to remove any items from the 5-item scale.

Item analysis is determined by examining the correlation between the score of each item of the scale and the total score. Each item of the scale has a moderate and high correlation with the total score ($p < 0.001$). The analysis revealed that all items demonstrated strong positive correlations with the total score, indicating good internal consistency. Specifically, the correlation coefficients were as follows: item Q1 ($r=0.85$), item Q2 ($r=0.81$), item Q3 ($r=0.90$), item Q4 ($r=0.73$), and item Q5 ($r=0.82$). These results suggest that each item contributes meaningfully to the overall construct being measured.

To establish convergent validity, the relationship between scores on the Dark Future Scale and those on the DASS-21, a tool measuring similar constructs, was analyzed. It was found that the correlation between these two scales was 0.56 and the result was significant ($p<0.001$) (Table 2).

**Table 2.** Correlation value observed between the Dark Future Scale (DFS) and DASS-21

| | **Mean±SD** | **Median** | **Min-Max** | **Quarter 25-75** | **Correlation Values with DFS** | |
|---|---|---|---|---|---|---|
| | | | | | **r** | **p** |
| **DASS-21** | 16.80 ± 14.38 | 13.0 | 0-63 | 6.0-26.5 | 0.56 | < 0.001 |

DASS-21: Depression, Anxiety and Stress Scale-21

In the CFA performed to test the 5-item DFS model, the values for the degrees of freedom ($\chi^2$/df), RMSEA, SRMR, and CFI were evaluated. $\chi^2$/df (11.7/5=2.34) and RMSEA (0.0666) showed acceptable fit, whereas SRMR (0.0154) and CFI (0.992) showed good fit. The goodness-of-fit statistics indicate that the DFS is acceptable. Table 3 shows the reference values and the fit values of the scale. [20]

**Table 3.** Confirmatory factor analysis values of the scale

| | X2 /df | RMSEA (%90 CI) | SRMR | CFI |
|---|---|---|---|---|
| **DFS CFA Values** | 2.34 | 0.067 (0.014-0.117) | 0.0154 | 0.992 |
| **Good fit indices** [20] | 0≤X2 /df≤2 | 0≤RMSEA≤0.05 | 0≤SRMR≤0.05 | 0.97≤CFI≤1 |
| **Acceptable fit indices** [20] | 2≤X2 /df≤3 | 0.05≤RMSEA≤0.08 | 0.05≤SRMR≤0.1 | 0.95≤CFI≤0.97 |

DFS: Dark Future Scale, RMSEA: root mean square error of approximation residual, SRMR: standardized root mean square residual, CFI: comparative fit index

*Reliability analysis of the DFS*

One of the reliability indicators is the corrected item-total correlation coefficient. The results show that the item-total correlation coefficient of the scale items varies between 0.73-0.90. The acceptable lower limit of the alpha coefficient was determined as 0.70. No significant improvement in Cronbach's alpha was observed upon deletion of any single item, suggesting all items contribute reliably to the overall scale. The Cronbach's alpha coefficient of the DFS with five items was 0.89 (Table 4).

For the test-retest, another method of reliability analysis, 27 participants answered the DFS again three weeks later. The mean score of these 27 participants at the first evaluation was 18.74±6.67, and the mean score at the second evaluation was 17.70±7.84 ($p>0.05$). The test-retest reliability coefficient was 0.94. The total correlation values of the scale items were found to be above 0.40. Item-total correlations are given in Table 4.

**Table 4.** Cronbach's alpha coefficients of DFS items when the item is removed, and the item's total correlation coefficient of DFS

| Items | Alpha, if they deleted | Item total correlations |
|---|---|---|
| Q1 | 0.86 | 0.79 |
| Q2 | 0.88 | 0.71 |
| Q3 | 0.86 | 0.81 |
| Q4 | 0.88 | 0.70 |
| Q5 | 0.87 | 0.75 |
| Explained variance: 57.3% | Cronbach's alpha: 0.89 | |

Q: question, DFS: Dark Future Scale

## Discussion

It is important to develop scientific methods to objectively reveal the impact of future anxiety, which has increased in recent years in our country and in the world, on young people, and to take measures in this regard. The research aimed to evaluate the Turkish validity and reliability of the DFS, which is used to determine future anxiety in individuals. The DFS is a psychometric instrument that can be used by researchers after major life events such as natural disasters, diseases, wars, and economic crises, in which future anxiety plays a role because it is quick, easy to use, and effective.[21,22] The results of this research show that DFS is an effective and dependable tool for measuring future-oriented perceptions in the Turkish university student population.

The Cronbach's alpha value was 0.89 in our research and 0.88 in the original study by Zaleski et al..[7] The fact that the item-total score correlation values evaluating the reliability of the DFS are greater than 0.30 and the test-retest reliability coefficient is 0.94 indicates that the Turkish version of the scale is reliable. Torfayeh et al. in Iran, a test-retest reliability coefficient of 0.70.[23]

In this research, multiple validity assessment methods were applied to thoroughly evaluate the measurement tool's effectiveness and suitability. Content validity was examined to ensure that the items comprehensively cover the concept intended to be measured. To establish convergent validity, the scale's results were compared with those from other instruments assessing similar constructs, verifying relatedness. The correlation between each item and the total score was analyzed to assess how well individual items contribute to the overall scale, shedding light on internal coherence. Criterion validity was evaluated by relating the scale outcomes to external standards or benchmarks, confirming the practical applicability of the instrument. Lastly, construct validity was investigated to determine whether the scale accurately represents the theoretical framework and underlying factors of the construct. Collectively, these analyses confirm the scale's validity from multiple perspectives, supporting its use in the targeted population. The results show that the scale has Turkish validity. Torfayeh et al. found a convergent validity of 0.65, a material analysis of 0.31-0.74 ($p<0.001$), and construct validity of 0.58-0.78 ($p<0.001$).[23]

In the validity analysis of the scale, the DFS revealed a unidimensional structure similar to the original scale. In the Turkish study on the construct validity of the scale, a 5-item structure with a single subdimension was confirmed. In the Italian validity and reliability study, two subdimensions were identified: external (items 1, 2, and 4) and internal (items 3 and 5) (24) The fit indices used for the DFS in our study showed acceptable fit for $\chi^2$/df 2.34 and RMSEA (90% CI) 0.067 (0.014-0.117); good fit for SRMR 0.0154 and CFI 0.992. In the Italian study, a good fit was found for SRMR and CFI.[24] Thus, the indices found in the DFS show that the test is compatible and adequately validated. In another DFS validity study, published in 2023 and conducted on

students of 4 private universities, fit indices values were found to be $\chi^2$/df 4.3, RMSEA 0.083, SRMR 0.02, and CFI 0.988.[25]

A positive correlation was found between DFS and DASS-21 (r=0.56, p<0.001). It has been reported in the literature that correlations of 0.30 and higher calculated for the criterion validity coefficient can be considered as an indicator of test validity.[26] Similarly, an Italian study found a correlation of 0.479 between the Beck Depression Scale and the DFS.[24] Accordingly, the correlation between our scale and a valid and reliable scale for measuring depression, anxiety, and stress, such as the DASS-21, was stronger than the examples in the literature.

In our study, medical students were found to have strong anxiety about the future. This value was notably elevated in individuals reporting poor financial conditions. In a study conducted by Özen et al., it was shown that poor financial status increased the level of anxiety, in line with our study.[27] Moreover, when the citizenship status of the students who participated in our study was compared between Turkish and non-Turkish groups, it was shown that the total scale score was higher in students with Turkish citizenship. This shows that Turkish students are more anxious about the future.

The fact that the sample of the scale consists only of medical students limits the application of the scale in the general adult or young population. Therefore, it is recommended that the scale be tested in larger populations.

Testing the validity and reliability of a measurement tool, such as the DFS, designed to measure the future anxiety of individuals, particularly medical students who are known to have some concerns about their future today, will contribute to the literature.

The results show that the Dark Future Scale is valid and reliable and is an ideal instrument for measuring future anxiety in medical students. The scale is particularly short, making it easy for researchers and clinicians to use in their research and increasing the response rate of the questionnaires. For these reasons, the Turkish version of the DFS is a reliable instrument for both research and clinical settings.

**Ethical Considerations:** The study was approved by the Ethics Committee of Ankara Yıldırım Beyazıt University (Date: 12.05.2022-08; No: 2022-855).

**Conflict of Interest:** The authors declare no conflict of interest.

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