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Psychometric Properties of the Turkish Version of the Persevering Hope Scale: A Rasch Analysis Study

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Abstract

Background: Persevering hope, defined as the ability to maintain motivation when goals seem unattainable, represents a crucial psychological resource for mental health. This study aimed to examine the psychometric properties of the Turkish version of the Persevering Hope Scale (PHS) primarily using Rasch analysis, supplemented by classical test theory indices including internal consistency reliability.

Method: The study included 634 university students (72.9% female; Mage = 22.51 ± 4.08). Rasch analysis was employed to assess unidimensionality, item fit, and differential item functioning (DIF). Criterion-related validity was evaluated through correlations with the Adult Hope Scale, and convergent validity was examined using measures of theoretically related constructs and psychological health outcomes.

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Results: Rasch analysis indicated that all items demonstrated good fit (infit/outfit MNSQ = 0.71–1.17), with no evidence of differential item functioning (DIF) across gender. Furthermore, the results supported the unidimensional structure of the PHS (explained variance = 67.1%). The scale showed strong criterion-related validity (rs = 0.41-0.56, $p < 0.001$). Convergent validity was supported by significant correlations with flourishing ($r = 0.45$, $p < 0.001$) and psychological health outcomes.

Conclusions: The Turkish version of the PHS demonstrates robust psychometric properties with strong evidence of reliability, construct validity, and measurement invariance across genders. These findings support its use as a culturally valid instrument for assessing persevering hope in Turkish populations.

Keywords: Persevering hope, Rasch analysis, psychometric properties, cross-cultural validation

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Background

Understanding the psychological mechanisms that enable individuals to maintain well-being in the face of adversity has been a central concern in mental health research (1). While resilience-related constructs such as grit, optimism, and coping strategies have received considerable attention, the specific capacity to sustain hope when goals appear unattainable has been relatively overlooked (2). This dimension termed persevering hope is

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conceptually distinct from general resilience in that it specifically addresses the maintenance of positive motivation in seemingly hopeless circumstances, rather than the broader capacity to recover from or adapt to adversity. Recent global challenges, including the COVID-19 pandemic, have underscored the practical relevance of this construct, as many individuals faced prolonged periods of uncertainty without clear pathways to resolution (3). Within this context, persevering hope emerges as a particularly relevant psychological resource that warrants dedicated measurement and investigation. The concept of hope has garnered increasing research interest in the fields of psychology and mental health in recent years (4, 5), and this interest has become even more pronounced with the rise of the positive psychology movement (6).

Hope is considered a fundamental psychological construct thought to have a significant impact on individuals' ability to cope with difficulties, their psychological resilience, and overall well-being (7–9). Hope has been conceptualized through several major theoretical frameworks in the psychological literature. At least four prominent approaches can be identified, each offering distinct perspectives on the nature and measurement of hope. Snyder's Cognitive Model of Hope (7), which has dominated research for decades, conceptualizes hope as a cognitive set comprising agency thinking (the perceived capacity to initiate and sustain action toward goals) and pathways thinking (the perceived ability to generate routes toward goals). The Adult Hope Scale (AHS), developed

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based on this model (10), has been the most widely used instrument in hope research. While Snyder's model has been highly influential, it has been critiqued for its predominantly cognitive and individualistic orientation and its exclusive focus on goal-directed processes (11).

Alternative approaches have broadened the conceptualization of hope. Scioli et al.'s (11) Integrative Hope Theory proposes a more comprehensive model that incorporates attachment, mastery, survival, and spiritual dimensions of hope, emphasizing that hope involves emotional, cognitive, and relational components. Dufault and Martocchi's (12) multidimensional framework distinguishes between generalized hope (a broad sense of future positive expectation) and particularized hope (hope tied to specific outcomes), incorporating affective, cognitive, behavioral, affiliative, temporal, and contextual dimensions. Similarly, Herth (13) developed a clinical perspective on hope that emphasizes inner readiness, interconnectedness with others, and realistic assessment of possibilities, particularly in health-related contexts. Despite these diverse theoretical contributions, a critical gap remains in the conceptualization and measurement of hope that persists in the absence of achievable goals. Rueger et al. (2) addressed this gap by introducing the construct of persevering hope, defined as the capacity to maintain motivation and positive expectations even when goals appear unattainable. Unlike Snyder's model, which relies on pathways and agency tied to specific goals, persevering hope emphasizes "wait-power" the psychological endurance

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that sustains individuals through periods of prolonged uncertainty without clear routes to resolution. This construct extends beyond goal-oriented frameworks and captures a dimension of hope that is particularly relevant in chronic adversity, terminal illness, or existential crises where identifiable goals may not be present.

Several instruments have been developed to measure hope across different theoretical frameworks. The Adult Hope Scale (AHS; 10), the most widely used measure, assesses goal-directed hope through agency and pathways subscales. The Herth Hope Index (14) was designed for clinical populations and captures temporality/future orientation, positive readiness/expectancy, and interconnectedness. The Comprehensive Hope Scale (10) measures hope across mastery, attachment, survival, and spiritual domains. In Türkiye, the AHS has been adapted by Tarhan and Bacanlı (15) and has been the primary instrument for hope research. However, all these instruments predominantly focus on goal-directed aspects of hope or general positive expectation, leaving the specific dimension of maintaining hope when goals appear unattainable unmeasured. The Persevering Hope Scale (PHS; 2) uniquely addresses this gap by specifically assessing the capacity to sustain hope during prolonged adversity without identifiable pathways to resolution, a dimension not captured by existing instruments.

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The Persevering Hope Scale (PHS) was developed by Rueger et al. (2) across four independent samples to measure the construct of persevering hope, conceptualized as “wait-power.” The PHS is a brief four-item self-report measure that assesses individuals’ capacity to maintain hope and motivation even when their goals seem unattainable. In the original validation study, Rasch analysis demonstrated that the PHS possesses a unidimensional structure with good item fit (MNSQ = 0.72–1.24), adequate person reliability, and no significant differential item functioning across demographic groups. The scale showed meaningful associations with related constructs including dispositional hope, religiousness, and well-being indicators, while demonstrating incremental validity beyond Snyder’s agency and pathways dimensions (2). Given its unique focus on sustained hope under seemingly impossible conditions and its strong initial psychometric evidence, the PHS represents an important advancement in hope measurement that warrants cross-cultural validation.

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The conceptualization and experience of hope may vary significantly across cultures, influenced by societal values, religious beliefs, and collective experiences. Research suggests that hope manifestations and meanings can differ across cultural contexts, particularly in societies where religious beliefs and collective values play central roles in shaping psychological experiences (16). This cultural variation is especially relevant in the Turkish context, where both religious coping and collective resilience are integral to how individuals maintain and express hope (17). The Turkish

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understanding of hope often emphasizes perseverance through difficulties (sabır) and collective support systems, reflecting both Islamic traditions and cultural values. This cultural variation necessitates careful validation of psychological instruments across different cultural contexts to ensure their measurement equivalence and cultural appropriateness (18). Despite the cultural significance of hope in Turkish society, there is a notable absence of psychometrically sound instruments for assessing persevering hope in this context. While several hope measures have been adapted for Turkish populations, these primarily focus on goal-oriented aspects of hope rather than the capacity to maintain hope in seemingly impossible situations. Addressing this gap could provide significant theoretical and practical implications in the field of mental health, and cross-cultural validation studies can provide valuable insights into the universality and culture-specific aspects of the concept of hope.

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The present study aims to: (a) evaluate the psychometric properties of the Turkish version of the PHS using Rasch analysis, including the examination of unidimensionality, item fit, response category functioning, and differential item functioning across gender; (b) assess the construct validity of the Turkish PHS through its relationships with established measures of hope, personality, religious coping, and psychological well-being; and (c) provide evidence for the cross-cultural applicability of the PHS by comparing its psychometric properties with the original version.

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To achieve these objectives, Rasch analysis was employed as the primary psychometric approach, supplemented by classical test theory indices. Rasch analysis offers several distinct advantages over classical test theory for scale validation studies. First, Rasch modeling places item difficulty and person ability on the same linear scale (logit scale), enabling direct comparisons between items and respondents (19). Second, unlike classical test theory, Rasch analysis provides sample-independent item parameters and item-independent person parameters when data fit the model, which enhances the generalizability of psychometric findings (20). Third, Rasch analysis enables rigorous evaluation of response category functioning, ensuring that the rating scale operates as intended. Fourth, Differential Item Functioning (DIF) analysis within the Rasch framework allows for a precise examination of measurement invariance across groups, which is essential for cross-cultural validation. Finally, Rasch-based fit statistics provide item-level diagnostics that can identify specific problematic items, offering more detailed information than aggregate reliability indices from classical test theory.

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Gender-based DIF analysis was included because previous research has suggested potential gender differences in hope-related constructs, with some studies reporting that men and women may differ in how they experience and express hope (21). Furthermore, ensuring measurement invariance across gender is a fundamental requirement for valid group comparisons in applied research and clinical practice. Examining DIF across

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gender groups therefore provides essential evidence for the fairness and equivalence of the PHS across male and female respondents.

This validation study aims to contribute to the growing literature on cross-cultural hope measurement by providing initial psychometric evidence for the Turkish version of the PHS. The findings may offer insights into how persevering hope is measured in a Turkish cultural context and could inform future research on hope-related interventions.

General Methods

This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (Additional File 1)

Participants

Participants included six hundred and thirty-four university students from one of the universities in the Northwest part of Türkiye (72.9% female and 27.1% male; M_{Age}= 22.51±4.08). In addition to gender and mean age, participants' socioeconomic status (SES) was assessed based on self-reported perceived family income. The distribution indicated that 5.5% of the participants reported very low SES, 18% low, 61.7% middle SES, while 13.6% high, and 1.3% reported very high SES. For the recruitment process, students were contacted by email lists and were invited to participate in the study. Data were collected through an online survey webpage. The consent

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form to partake in the study was provided via the first page of the online survey. Participants were informed about the purpose of the study, the right to withdraw during or after the involvement, and assured about the anonymity and confidentiality of storage, and the disposal of the personal information. Procedures for data collection were approved by the Bursa Uludag University Social and Human Sciences Research Ethics Committee (Approval Reference: E-92662996-044-60635).

Measures

Persevering Hope Scale (PHS). Before data collection, PHS was translated into Turkish following standard forward–backward translation procedures. First, two bilingual experts independently translated the original English version into Turkish. These translations were compared and synthesized into a single version through consensus. The synthesized Turkish version was then back-translated into English by an independent bilingual translator who was blind to the original instrument. The back-translated version was reviewed against the original scale to ensure semantic and conceptual equivalence.

The preliminary Turkish version was subsequently evaluated by 2 experts in psychology and educational sciences for linguistic clarity and content appropriateness. Minor revisions were made based on expert feedback.

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The final PHS revealed a four-item self-report measure assessing individuals' capacity to sustain goal-directed effort and motivation in the face of challenges. Items are rated on a five-point Likert scale ranging from 1 (not at all) to 5 (very much), with higher total scores indicating higher levels of persevering hope. In the present study, the internal consistency of the scale was high (Cronbach's α = .91).

Adult Hope Scale (AHS). The AHS is a twelve-item measure in which the items are rated using an eight-point response scale (1=definitely false and 8=definitely true) (9). The scale consists of agency and pathway subscales that assess the perceived capability of goal achievement (agency) and perceived capacity to generate routes towards the desired goal (pathways). The total hope score of the scale is obtained by the sum of the agency and pathway scores, and higher scores on the scale demonstrate higher goal-directed hope. Tarhan and Bacanlı (15) provided the Turkish version of the scale and current study reports Cronbach's alpha of 0.77 for AHS.

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Brief Religious Coping Scale (B-RCOPE). The B-RCOPE is a ten-item self-report measure that is rated using a four-point response scale. The total score of the scale was obtained by summing the item scores of the respondents, and higher scores on the scale indicated higher levels of religious coping. The Turkish version of the scale has satisfactory psychometric qualities (17) and current study reports Cronbach's alpha of 0.93 for B-RCOPE.

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Flourishing Scale (FS). The FS is an eight-item measure, and the items are answered using a seven-point agreement scale rated based on a seven-point response scale (1=strongly disagree, 7=strongly agree) (22). Higher values represent greater satisfaction with the important areas of positive functioning. The Turkish translation of the scale has demonstrated satisfactory psychometric properties (23) and current study reports Cronbach's alpha of 0.86 for FS.

Depression, Anxiety, and Stress Scale (DASS-21). DASS-21 is a twenty-one-item self-report questionnaire in which the items are rated using a four-point response scale (0=always false, 4=always true). The scale comprises three subscales: depression, anxiety, and stress, and the subscale scores are obtained via the sum of the item scores of the relevant dimensions, with higher scores indicating higher levels of depression, anxiety, and stress (24). The Turkish adaptation of the scale revealed good psychometric properties (25) and current study reports Cronbach's alphas of 0.89, 0.86 and 0.88 for depression, anxiety and stress subscales for DASS-21.

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Data Analyses

Model–data fit was first evaluated using infit and outfit Mean Square (MNSQ) statistics to identify items that did not adequately conform to the Rasch model, as such items may reduce measurement precision (26). Items were considered misfitting if either infit or outfit MNSQ values fell outside the acceptable range of 0.6–1.4, in line with established Rasch guidelines

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(27). Items meeting these criteria were retained for subsequent analyses. Following the evaluation of model fit, unidimensionality was examined using Principal Component Analysis of Residuals (PCAR). As a general rule, an eigenvalue of less than 2.0 for the first contrast in the unexplained variance is considered indicative of unidimensionality (28). Given that acceptable model fit was established, the examination of residuals through PCAR was considered appropriate. Additional Rasch-based indices, including person and item reliability and separation, were calculated to assess the precision and discriminative capacity of the scale. Person separation values of at least 2.0 and person reliability values above 0.80 were considered acceptable (29). Higher values of item separation (>3.0) and item reliability (>0.90) indicate adequate item distribution along the latent trait continuum. Person reliability reflects the consistency of person ordering across repeated measurements, whereas person separation indicates the ability of the instrument to distinguish between different levels of the latent trait. Both indices were reported as they provide complementary information regarding measurement quality (30).

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Point-measure correlations (PT-Measure CORR) were examined to assess the alignment between item responses and the underlying latent trait. Finally, Differential Item Functioning (DIF) analysis was conducted to evaluate whether items functioned equivalently across gender. DIF contrasts greater than 0.5 logits, accompanied by statistically significant t-values, were considered indicative of potential item bias.

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In addition to Rasch-based analyses, internal consistency reliability was assessed using Cronbach's alpha. Correlation analyses were performed to examine the evidence of criterion-related and convergent validity. Pearson's r was used to determine the effect size based on the following criteria: .10 (small), .30 (medium), and .50 (large) effect size (31). To evaluate the incremental value of PHS scores over agency, pathways, and agency/pathways together on theoretically related constructs and psychological health outcomes, hierarchical multiple regression analyses were conducted. Four sets of models were tested, with variables entered in the following order: Agency, Pathways, both Agency and Pathways together in Step 1, and PHS scores in Step 2. Cohen's f2s was used to determine the incremental value of PHS, controlling for the Adult Hope Scale dimensions of agency and pathways (.02, .15, and .35 for small, medium, and large, respectively) (31) Rasch analyses with Rating Scale Model (RSM) were conducted using Winsteps version 5.8.0.0. Specifically, item fit statistics (infit and outfit mean square values), person and item reliability and separation indices, response category functioning, Principal Component Analysis of Residuals (PCAR), and Differential Item Functioning (DIF) analyses were performed using Winsteps. Classical test theory analyses were conducted using SPSS version 23.0. These analyses included descriptive statistics, internal consistency reliability estimates (Cronbach's alpha), Pearson correlation analyses to examine criterion-related and

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convergent validity, and hierarchical multiple regression analyses to evaluate incremental validity.

Results

Rasch Analyses

Model–data fit was first evaluated using item fit statistics. All infit and outfit Mean Square (MNSQ) values ranged from 0.71 to 1.17, indicating that all items fit the Rasch model within the acceptable range (0.6 < MNSQ < 1.4). Person and item reliability were 0.85 and 0.95, respectively, while person and item separation indices were 2.41 and 4.47. These findings indicate that the scale has adequate precision and is capable of distinguishing between different levels of the latent trait. The alignment between item responses and the underlying construct was evaluated using point-measure correlations (PT-Measure CORR). The results indicated no inverse correlations, with all items showing moderate positive associations with the latent trait. Furthermore, no notable discrepancies between observed and expected values were observed in the PT-Measure-EXP statistics (Table 1).

Given that acceptable model fit was established, unidimensionality was subsequently examined using Principal Component Analysis of Residuals (PCAR). The results showed that the variance explained by the Rasch dimension was 67.1%, and the eigenvalue of the first contrast in the

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unexplained variance was 1.72, supporting the unidimensionality of the scale (variance > 0.30; eigenvalue < 2.0).

Differential Item Functioning (DIF) was examined across gender. Based on the criteria of a DIF contrast greater than 0.5 logits and a statistically significant t-value, no evidence of DIF was found, indicating that the items functioned equivalently for male and female participants (Table 1).

Validity Analyses

We present evidence supporting the criterion-related validity of PHS scores in Table 2. The criterion-related validity of the PHS was determined based on the correlations between agency, pathways, and total AHS scores, as shown in Table 2 (rs= |0.41-0.56|). In terms of convergent validity, PHS scores were associated with scores on measures of theoretically related constructs (rs= |0.19-0.33|) and psychological health outcomes (rs= |0.12-0.45|). According to Cohen's (1988) guidelines for interpreting correlation effect sizes (r = 0.10 small, 0.30 medium, 0.50 large), these correlations represent medium to large effect sizes, indicating substantial associations between persevering hope and goal-directed hope constructs.

In terms of incremental validity, PHS scores were significantly associated with theoretically related constructs such as positive religious coping, controlling for agency, pathways, and agency/pathways together (f2s=0.017-0.037). PHS scores were also significantly correlated with

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psychological health outcome scores on measures of flourishing, depression, and stress, controlling for agency (Depression; f2s=0.007), pathways (f2s=0.03-0.06), and agency/pathways (f2s=0.013-0.089).

.....Table 2.....

Discussion and Conclusion

This study evaluated the psychometric properties of the Turkish version of the Persevering Hope Scale (PHS) using Rasch analysis in a sample of 634 university students. The results provide initial evidence supporting the unidimensionality, item fit, measurement invariance across gender, and construct validity of the Turkish PHS. Below, we discuss the key findings in relation to existing literature and their implications for hope research and practice.

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The Rasch analysis results of the Turkish PHS demonstrated good item fit (MNSQ = 0.71–1.17), which is comparable to the fit values reported in the original PHS validation study by Rueger et al. (2; MNSQ = 0.72–1.24). The explained variance of 67.1% in the Turkish sample is also consistent with the original study’s findings, supporting the validity of the PHS for Turkish respondents. Taken together, these results suggest that the Turkish version of the PHS demonstrates psychometric properties comparable to those reported in the original validation study (2), providing initial evidence for the cross-cultural applicability of the instrument.

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All items demonstrated acceptable fit to the Rasch model, with both infit and outfit Mean Square (MNSQ) values falling within the acceptable range of 0.6–1.4 (27). Specifically, infit MNSQ values ranged from 0.71 to 1.17, and outfit MNSQ values ranged from 0.71 to 1.12, indicating that all items contribute meaningfully to the measurement of the persevering hope construct without evidence of misfit. The Point-Measure correlations (PT-Measure CORR; ranging from 0.86 to 0.90) indicate that the items are highly correlated with the measured construct. Furthermore, the absence of significant Differential Item Functioning (DIF) across gender (all p-values > 0.05) suggests that the scale provides equivalent measurement for male and female respondents, consistent with previous studies proposing that hope is experienced similarly across genders (6, 34). The consistent unidimensional structure, acceptable item fit, and absence of gender-based DIF collectively support the structural validity and measurement fairness of the Turkish PHS.

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The Principal Component Analysis of Residuals (PCAR) results supported the unidimensionality of the Turkish PHS. The eigenvalue of the first contrast in the unexplained variance was 1.72, which is below the commonly used threshold of 2.0 (29), indicating no meaningful secondary dimension. Additionally, the Rasch dimension explained 67.1% of the total variance, exceeding the minimum criterion of 50% recommended for unidimensional scales (29). Together, these results provide strong evidence

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that the PHS measures a single coherent construct in the Turkish sample, supporting its construct validity.

The acceptable Rasch reliability indices suggest that the construct of persevering hope can be coherently measured within the Turkish cultural context, possibly reflecting the cultural emphasis on ‘sabır’ (patience) and collective resilience. Furthermore, the moderate association between persevering hope and flourishing ($r = 0.45$, $p < 0.001$) suggests that the capacity to maintain hope may function as an adaptive psychological resource, at least within the cultural context represented by the present sample.

Correlation analyses demonstrate that the PHS possesses strong criterion validity. The moderate positive correlations between PHS scores and Adult Hope Scale (AHS) scores ($rs = |0.56\text{-}0.59|$, $p < 0.001$) support its criterion validity. These findings confirm that persevering hope is related to, yet distinct from, the goal-oriented hope conceptualized by Snyder (10). This pattern of moderate correlations is consistent with the proposition that persevering hope may represent a partially distinct dimension of the broader hope construct, although the correlational nature of these findings does not constitute definitive evidence for a multidimensional model of hope. Nevertheless, persevering hope may serve as a meaningful psychological resource, particularly in challenging life circumstances (32).

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The observed correlations between PHS scores and theoretically related constructs—including positive religious coping as measured by the Brief Religious Coping Scale ($r = 0.19$, $p < 0.001$)—as well as psychological health outcomes measured by the Flourishing Scale ($r = 0.45$, $p < 0.001$) and the Depression, Anxiety, and Stress Scale (depression: $r = -0.26$; anxiety: $r = -0.12$; stress: $r = -0.26$) provide evidence for the convergent validity of the Turkish PHS.

When interpreting these findings, it is important to consider effect sizes alongside statistical significance, particularly given the large sample size ($N = 634$), which increases statistical power and may render even small effects statistically significant. Following Cohen's (31) guidelines, the correlations between PHS and criterion measures ranged from medium to large ($r = 0.41$–0.56), while convergent validity correlations ranged from small to medium ($r = 0.12$–0.45). The small but statistically significant positive correlation between PHS scores and positive religious coping ($r = 0.19$, $p < 0.001$) suggests a modest association in the Turkish context. While this association is small in magnitude, it may reflect a meaningful cultural connection, as religious coping is an important resource in Turkish society. However, given the small effect size, the practical significance of this relationship warrants further investigation. The small correlations with some measures (e.g., anxiety, $r = -0.12$), while statistically significant, should also be interpreted with appropriate caution regarding their practical significance.

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The PHS's ability to significantly predict various psychological variables even after controlling for the dimensions of the AHS (agency and pathways) (ΔR^2 values in Table 2) points to the scale's incremental validity. For instance, PHS scores significantly predicted levels of flourishing ($\Delta R^2 = 0.01$, $p < 0.05$) and depression ($\Delta R^2 = 0.01$, $p < 0.05$) even after controlling for the agency and pathways dimensions of the AHS. This finding demonstrates that persevering hope is a unique construct beyond the traditional concept of hope and offers an additional dimension that should be considered in mental health research (2). These incremental validity findings suggest that persevering hope captures unique variance in psychological outcomes beyond what is accounted for by Snyder's goal-directed hope dimensions.

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Theoretical and Practical Implications

The findings of this study contribute to the psychometric literature on hope measurement by providing initial validation evidence for the Turkish PHS. The moderate correlations between PHS scores and Snyder's AHS dimensions ($r = 0.41–0.56$) suggest that persevering hope is related to, yet partially distinct from, goal-oriented hope. However, it should be noted that this psychometric evidence alone does not establish the theoretical structure of hope; rather, it provides empirical grounds for the continued investigation of persevering hope as a potentially distinct component of the broader hope construct. From a practical standpoint, the Turkish PHS offers

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researchers and clinicians a brief, psychometrically sound instrument for assessing persevering hope. The scale's brevity (four items) makes it particularly suitable for use in research batteries and clinical screening contexts. However, practitioners should be cautious about using the PHS in isolation for clinical decision-making until further validation studies, including those with clinical populations, are conducted.

Strengths and Limitations of the Study

The strengths of this study include the use of Rasch analysis, which provides rigorous item-level psychometric evaluation beyond classical test theory indices, and the inclusion of multiple measures to assess construct validity. However, several limitations should be acknowledged. First, the sample was predominantly composed of female university students (72.9%), which may limit the generalizability of the findings to the broader population and to male respondents. Although DIF analyses did not reveal significant gender differences in item functioning, the gender imbalance warrants caution in generalizing the results. Second, data were collected exclusively through an online survey platform, which may introduce self-selection bias, as individuals without internet access or those less inclined to participate in online research were not represented. Third, the cross-sectional design precluded the assessment of test-retest reliability and the examination of the temporal stability of PHS scores. Fourth, the sample consisted solely of university students from a single institution in

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Northwestern Türkiye, which limits the generalizability to non-student populations, clinical samples, and different geographical regions of Türkiye. Fifth, convenience sampling was employed, which may not be representative of the broader Turkish population. Sixth, the absence of a confirmatory factor analysis using classical test theory methods alongside Rasch analysis limits the comprehensiveness of the structural validity evidence. Future studies should address these limitations by employing more diverse and representative samples, using multi-site recruitment, incorporating longitudinal designs, and including both classical and modern psychometric approaches.

While the comparable psychometric properties between the Turkish and original English PHS provide initial evidence for the instrument's cross-cultural applicability, it should be noted that these comparisons are indirect, as the current study only involved a Turkish sample. Stronger evidence for cross-cultural validity would require formal multi-group invariance testing across cultural samples within a single study. Therefore, the present findings should be considered as preliminary support for the PHS's cross-cultural potential, and future research should directly examine measurement invariance across cultural groups.

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Recommendations for Future Research

Future research should conduct longitudinal studies to examine changes in persevering hope over time and its long-term effects on mental

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health. Moreover, it is important to evaluate the psychometric properties of the PHS in clinical samples and investigate the role of persevering hope in the treatment process. Exploring the neurobiological foundations of persevering hope and testing the effectiveness of hope-based intervention programs will expand our knowledge in this field.

Conclusion

This study provides initial evidence that the Turkish version of the Persevering Hope Scale demonstrates acceptable psychometric properties based on Rasch analysis, including a unidimensional structure, adequate item fit, and absence of differential item functioning across gender. The scale showed meaningful associations with theoretically related constructs, supporting its construct validity in a Turkish sample. These findings suggest that the PHS can be used as a brief measure for assessing persevering hope among Turkish university students. However, the findings should be interpreted within the context of the study's limitations, including the predominantly female, university-student sample and the cross-sectional design. Future research should examine the PHS's performance across more diverse Turkish populations, clinical samples, and longitudinal designs to further establish its psychometric properties and practical utility.

List of Abbreviations

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PHS: Persevering Hope Scale AHS: Adult Hope Scale DIF: Differential Item Functioning PCAR: Principal Component Analysis of Residuals MNSQ: Mean Square PT-Measure CORR: Point-Measure Correlation RSM: Rating Scale Model TIPI: Ten Item Personality Inventory B-RCOPE: Brief Religious Coping Scale FS: Flourishing Scale DASS-21: Depression, Anxiety, and Stress Scale-21 SES: Socioeconomic Status STROBE: Strengthening the Reporting of Observational Studies in Epidemiology

Declarations

Ethics approval and consent to participate: This study was performed in accordance with the Declaration of Helsinki and was approved by the Bursa Uludag University Social and Human Sciences Research Ethics Committee (Approval Reference: E-92662996-044-60635). All methods were carried out in accordance with relevant guidelines and regulations. Prior to data collection, all participants were informed about the research objectives, data collection method, voluntary nature of participation, and their right to withdraw at any time. Informed consent was obtained from all participants via the first page of the online survey.

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Consent for publication: Not applicable.

Availability of Data and Materials: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

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HB planned the study, collected data, performed statistical analyses, and wrote the Method and Results sections

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Tables

Table 1. Infit, outfit, and DIF estimations for each item

			Infit	Outfit	PT-Measured		DIF Statistics	
Item	Measure	Model SE	MNSQ	MNSQ	CORR.	EXP.	DIF Contrast	*p*
Item 3	0.63	0.11	1.09	1.04	0.89	0.89	-0.41	0.09
Item 4	0.10	0.11	1.17	1.12	0.86	0.88	0.20	0.42
Item 1	-.0.22	0.11	0.95	0.94	0.87	0.88	0.29	0.26
Item 2	-0.51	0.11	0.71	0.71	0.90	0.87	-0.03	0.90
Item Mean	0.00	0.11	0.98	0.95	-	-	-	-
SD	0.42	0.00	0.17	0.15	-	-	-	-

Table 2. Evidence of criterion-related, convergent, and incremental validity of scores on the Persevering Hope Scale

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Variable	Cronbach's α	Correlations with PHS	ΔR^2 (β)over Agency	ΔR^2 (β) over Pathways	ΔR^2 (β) over Agency+ Pathways
Criterion-related validity					
Agency	0.82	0.553***	-	-	-
Pathways	0.75	0.408***	-	-	-
Agency+ Pathways	0.77	0.556***	-	-	-
Convergent validity					
Theoretically related constructs					
Positive religious coping	0.93	0.189***	0.017 (0.157***)	0.037 (0.211***)	0.025 (0.189***)
Psychological health outcomes					
Flourishing	0.86	0.454***	0.002 (0.060)	0.089 (0.327***)	0.007 (0.100**)
Depression	0.89	-0.255***	0.007 (-0.101*)	0.053 (-0.252***)	0.017 (-0.158***)

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Anxiety	0.86	-0.117**	0.000 (-0.021)	0.013 (-0.126**)	0.003 (-0.065)
Stress	0.88	-0.260***	0.002 (-0.054)	0.024 (-0.170*)	0.07 (-0.104*)

Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

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