Vegueta. Anuario de la Facultad de Geografía e Historia
24 (1), 2024
eISSN: 2341-1112
DOI: 10.5281/zenodo.7538419

PSYCHOMETRIC PROPERTIES OF PETRIDES TRAIT EMOTIONAL INTELLIGENCE SCALE IN SAUDI ARABIA KINGDOM USING ITEM RESPONSE THEORY AND LATENT PROFILE ANALYSIS

Abdullah khretan Alenezi
Associate Professor of Psychology, College of social Sciences, Imam Muhammad Ibn Saud Islamic University, Akenezi@imamu.edu.sa

Fahad Saeid Alanazi
Associate Professor of Clinical Psychology, Psychology department, Tabuk University
f.alanazi@ut.edu.sa

Mahmoud Ali Moussa
Educational Psychology department, Faculty of Education, Suez Canal university
mahmoud_muhanna@edu.suez.edu.eg

Izzeldeen Abdullah Alnaimi
Faculty of Social Sciences, Department of Psychology, Imam Mohammad Ibn Saud Islamic University
eaalnuaimi@imamu.edu.sa

Abstract:
The study aimed to verify the psychometric properties of Petrides' trait emotional intelligence structure for university students in the Saudi community. The initial sample for analysis consisted of 250 students from Imam Muhammad bin Saud Islamic University, who completed the 30-item measure online via the Google Forms platform. The study confirmed the unidimensionality using a confirmatory factor analysis model and found it fit the data. It addressed the issue of local dependence by creating residual correlations. The study estimated the initial reliability of the measure, which was 0.727. After separating the items and persons the final sample was 165, the alpha reliability was .786 and person separation reliability increased from 0.630 to 0.815. Two items 9, 27 were excluded from the final construct. The range of individual differences in the measured trait was wide, while the latent trait was centered around zero, with most items located in the medium difficulty region. Two items, 1 and 17, were highly sensitive to emotionality across individuals. The study relied on classifying latent categories of high and low emotional intelligence and used the discriminant function of differences in performance on the measure items across the two groups. The items were found to be sufficiently discriminative, except for item 14, which suggests the need to either exclude the item or interpret the results cautiously due to its sensitivity to the highly emotional trait.

**Autora de correspondencia / Corresponding author.*

Keywords: Emotional intelligence; Latent profile analysis; Emotional self-efficacy; Latent trait theory.

Introduction:

The nature of measurement differs from one trait to another, depending on the nature of the underlying traits being estimated, due to the difference between the true score and the total score. For example, the true score approaches the total score in the case of the disappearance of measurement errors for the cognitive trait when measured once. However, in the case of affective traits, the total score or the nature of the underlying trait being measured may fluctuate due to exaggeration in describing the phenomenon, falsification of emotional expression, or the pressures experienced by the person, or due to cases of alexithymia that accompanied individuals in the aftermath of COVID-19 and the resulting periods of recession or loss of lives and money. Additionally, the complex emotions experienced by the learner, especially at the university level, as a continuation of the COVID-19 periods that affected their cognitive and emotional levels, as indicated by studies (Alharbi et al., 2022; Alharbi et al., 2024), have also affected their social nature and led to their continued desire to distance themselves from live interaction with others, either due to perceived emotional details or to avoid interaction, as indicated by studies (Abdel Aziz & Moussa, 2022; Ali Moussa & Khretan Alenezi, 2022).

Moreover, the existence of diverse groups in emotional traits within the same community has created a gap in measurement, which has led to the use of modern theory, such as item response theory, to evaluate emotional trait measures, and the use of latent profile analysis to estimate more homogeneous groups of differences within those groups, as a consideration for the selection of groups on which counseling and treatment interventions are performed.

Therefore, this study aims to use the Rasch-Andrich model to obtain a concise version of the Petrides Emotional Intelligence Trait Measure, study the fit of items and persons, and use Wright map summary plots to identify the distribution of item difficulty in light of the underlying traits being measured and the characteristics of the subscales. It also aims to divide the measured latent traits into homogeneous groups in terms of individual differences within the groups and to study the discriminant function across the study groups.

Item Response Theory:

Item Response Theory (IRT) is concerned with the precise measurement of assessment tests and the growth of scale items (An & Yung, 2014). IRT is an approach that models the relationship between responses to measurement instrument items and the underlying latent traits being measured, using statistical models that depend on the nature of the response, whether binary (dichotomous) or ordinal (polytomous) (Lang & Tay, 2021). The measurement can be structured in a hierarchical or multi-response modeling framework, where the latent variables under analysis may be continuous (latent factors) or discrete (latent categorical variables) (Cai et al., 2016). The measurement idea in this theory is to find a unified way of measurement.

Measurement items can be designed to assess different types of capabilities (e.g. emotional capacities), traits (e.g. emotional intelligence characteristics), or behavioral qualities (e.g. self-efficacy) (An & Yung, 2014). The item responses can be binary (0, 1) (e.g. presence or absence of a response, or agreement vs. disagreement), or fall on an ordinal measurement scale (e.g. levels of agreement on a Likert scale) (An & Yung, 2014).

The theory assumes that the variance in item responses is due to a latent continuous variable (common factor). The theory is an indicator of the effects, meaning that the latent trait causes the variance in item responses

(Reise & Waller, 2009). IRT has several advantages: 1) Detailed description of the performance of individual items, 2) Precision indicators at the item and scale level that can vary across the range of possible scores, 3) Evaluation of bias at the item and test level in relation to demographic subgroups (Differential Item Functioning - DIF), 4) Measures of response pattern quality, and 5) Computer-adaptive test calibration.

Item response theory models vary, including models that handle dichotomous items (where the response is scored as right or wrong) and the key requirement is that the item response for each person has the ability to produce a binary branch. There are also models for polytomous or multi-response items (where the item response has more than two values, such as Likert-type attitude tests or survey items), including the Partial Credit Model and the Andrich Rating Scale Model (Harvey & Hammer, 1999).

The assumptions of item response theory include:

1. Unidimensionality, all item response theory (IRT) models rely on the assumption that the set of items revolves around a general factor in some way. Even the multidimensional models of this theory have adopted this condition. Some statistical methods have been used to support this assumption, such as the Bifactor model and second-order factor analysis, which focus on a general factor, or a single latent trait, for the set of items (Harvey & Hammer, 1999). Jacobs et al. (2015) conducted in a German context; the researchers tested a second-order general factor for the internal factors of the Emotional Intelligence Scale. The model showed acceptable fit but had issues with reliability because there were correlations between the measurement errors of two items. Additionally, Perez-Diaz et al. (2021) tested a Bifactor model to determine the presence of general emotional intelligence traits as a meaningful overall score. They also examined the four-trait model using the same approach, thus establishing unidimensionality as a requirement for IRT modeling. A study using the graded response model and confirmatory factor analysis tested the model as a single group without considering the different cultures of the students involved. This study demonstrated good fit for the general factor using a stricter measurement method known as Robustness Unweighted Least Squares.
2. The Latent Trait, the latent trait is an unobserved characteristic or property that is assumed to be responsible for the observed responses given by individuals on test items. It is represented by the symbol theta (θ). This latent trait is similar to the true score estimated by traditional classical measurement models. According to the principle of unidimensionality, it is assumed that there is a single latent trait that underlies individuals' responses to test items, often referred to as "ability." Additionally, item characteristics, such as difficulty and discrimination, are estimated for the items being analyzed (Harvey & Hammer, 1999).
3. Homogeneous Subpopulation, a homogeneous subpopulation refers to a group of individuals who are similar in terms of their scores on the underlying ability or latent trait being measured (Harvey & Hammer, 1999). In psychological measurements, even with strict experimental controls in quasi-experimental designs, it is challenging to achieve completely homogeneous individuals in terms of emotional dispositions, which are inputs for counseling or therapeutic programs. Graduate students pursuing master's and doctoral degrees have frequently reported obtaining illogical results, particularly after the COVID-19 pandemic. The pressures and restrictions imposed during this period affected human psychology, leading to unusual research outcomes and raising doubts about the validity of these results.

4. Probability of Item Endorsement, the probability of item endorsement refers to the likelihood of responding to an item correctly. It is defined as the proportion of respondents in each homogeneous subpopulation who answer correctly for tests scored dichotomously, or who follow a response guide that indicates the correctness of their answers. Selecting individuals for inclusion in counseling, therapeutic, or clinical programs based on cutoff points (such as the mean, median, or the 25th or 75th percentile) has become increasingly challenging. This difficulty arises because the sample might differ in certain demographic variables, or the accuracy of the diagnostic methods used by researchers might be questionable. Thus, it is crucial to ensure the diagnostic accuracy to logically and accurately interpret the chosen cutoff value for diagnosing a specific trait or determining the absence of that trait. This can be supported by ROC (Receiver Operating Characteristic) curve analysis. Consequently, the cutoff points derived from ROC curve analysis or from latent profile or class analysis may result in a high probability of item endorsement.

Problem and Aim of the Study:

Measuring emotional aspects is extremely challenging, as emotional reactions, which are considered a part of emotional self-efficacy, stem from two sources (Stanton et al., 1994):

1. **Expression of Emotions**: Expressing emotions is confusing and ambiguous, and personal traits often do not facilitate emotional adaptation, leading to distorted human judgment (Petrides, 2010; Stanton et al., 1994).
2. **Toxic Positivity**: According to Baker & Berenbaum (2007), there are two types of adaptation:
    - **Problem-Solving Adaptation**: This relies on the emotional processing of stimuli, requiring clarity of emotions and attention to feelings. Successful adaptation in this context needs personal experience to handle accumulated emotional knowledge in different situations and to manage it with social intelligence (Baker & Berenbaum, 2007; Petrides, 2010).
    - **Emotion-Based Adaptation**: This type of adaptation deals with stressful events or emotionally charged environments and focuses on personality traits rather than achievement (Baker & Berenbaum, 2007).

Therefore, traits of emotional intelligence are related to long-term emotional states or focus on the mood accompanying a person (Moussa, 2021).

Emotional intelligence traits are defined as a constellation of an individual's emotional perceptions about themselves, which provide insights into the lower levels of the personality hierarchy. In adults, the trait of emotional intelligence falls outside the classification of human cognitive ability, as it reflects behavioral aspects of personality and personal emotional judgments (Petrides, 2010). Emotional self-efficacy is linked to adaptive social behavior, and unfamiliar contexts present obstacles in emotional expression or actions suitable for those contexts (Petrides et al., 2007). Additionally, pre-existing generalizations distort an individual's emotional decision-making over long periods (Petrides et al., 2016).

Another perspective by Petrides et al. (2016) and Siegling et al. (2015) explains the difficulty in perceiving emotional aspects. They suggest that emotional intelligence traits represent a multidimensional hierarchical structure in explaining emotions and that emotional intelligence does not fully cover the variation in emotional perceptions. This structure also conceals differential relationships between aspects of emotional intelligence traits and the standards of those traits possessed by an individual. On the other hand, Orhan (2024) views emotional intelligence as a trait that is a skill and a continuous behavioral pattern that can be improved over time through personal experience, the development of self-efficacy beliefs, behavioral tendencies, and emotional information processing to achieve well-being and adapt to the environment.

The current study aims to address the conflicting interpretations of emotional intelligence trait approaches by more accurately estimating psychometric properties through item response theory. It seeks to determine the difficulty of items in capturing the complexity of emotional traits, provide person-specific information indices, summarize the hierarchical structure of the scale, and offer a more precise framework for psychological, clinical, and diagnostic interventions. This is done considering the latent profile analysis approach for latent traits and by estimating the discriminatory ability of items among the resulting groups using DIF (Differential Item Functioning) for ordinal data.

Method and Procedures

Participants: The study utilized a cross-sectional design. The sample consisted of 250 students from Imam Muhammad ibn Saud Islamic University. The sample was conveniently selected from students in various colleges. The sample was divided based on the nature of the study into 119 (47.6%) from scientific colleges and 132 (52%) from humanities colleges. The gender distribution of the sample was 144 (57.6%) males and 106 (42.4%) females. The age distribution of the sample was as follows: 206 (82.4%) were aged 18 to 22 years, 25 (10%) were aged 23 to 27 years, 11 (4.4%) were aged 28 to 33 years, and 8 (3.2%) were aged over 33 years.

The Trait Emotional Intelligence Scale: developed by Petrides and Furnham (2001), conceptualizes emotional intelligence as a set of emotional self-perceptions that are situated at the lower levels of the personality hierarchy. This construct relates to individuals' self-assessments of their emotional capabilities and has therefore been described as a trait of emotional self-efficacy. The scale was validated on the Saudi Arabia society by Alenezi et al. (2024).

The scale comprises four factors: well-being, which includes items 5, 9, 12, 20, 24, and 27; self-control, which includes items 4, 7, 15, 19, 22, and 30; emotionality, which includes items 1, 2, 8, 13, 16, 17, 23, and 28; and Sociability or social skills, which includes items 3, 6, 10, 11, 14, 18, 21, 25, 26, and 29. Respondents complete the 30-item scale. The students have ended response to the scale according to their freely without time limits. The response options were reduced from a 7-point to a 5-point Likert scale, with the following options: 1 = does not apply at all, 2 = does not apply, 0 = between and between (indicating the respondent is unaware of their true feelings), 3 = applies sometimes, and 4 = applies completely.

Procedures: The study aims to adapt and evaluate the psychometric properties of an Emotional Intelligence Traits scale in a sample of students from Imam Muhammad bin Saud Islamic University in the Kingdom of Saudi Arabia. The study procedures can be outlined as follows:

1. Missing Data: There was no missing data in the students' online responses to the scale items.
2. Unidimensional Scale Structure: Confirmatory factor analysis was used to examine the four-factor structure of the scale, testing a second-order factor model as well as a bifactor model, to verify the unidimensionality of the scale through two different approaches. Residual covariances between scale items were included to improve model fit, allowing for local independence to be achieved.
3. Assessing Data Normality: The initial indicators of latent trait analysis were used to verify the linear normality of the data. The skewness index for the total score on the Emotional Intelligence Traits scale was -0.960, indicating the data followed a normal distribution.
4. Controlling for Speed Factor: The scale was administered to students with no time limit, allowing them to respond at their own pace and complete the measure within the time they deemed appropriate, to eliminate any potential speed factor effects.
5. Using the Jamovi 2.3.26 software to enable the use of the R language and some other internal software for analysis procedures.
6. The items of the scale (30 items) were calibrated on the total sample (n = 250 cases), and the reliability of person separation for the initial data was 0.630, and the scale reliability was 0.726 with Cronbach's alpha and 0.727 with omega coefficient. The detailed fit indices Infit & Outfit were examined, and items were excluded, and the analysis repeated until the indices fell within the acceptable range for all items (.50 to 1.5), and person separation reliability was calculated at the end of the item calibration.
7. Estimating the difficulty parameters for each item of the test in the shortened form resulting from the separation of items and persons (sample size for persons 165 and the final number of items was 28). The alpha reliability for the items was 0.786 and the omega coefficient was 0.787.
8. Interpreting the Wright map to compare the difficulty parameters in relation to the individual abilities to evaluate the individual differences in emotional intelligence as general traits, and making a graphical representation to compare the latent traits of the measured ability in emotional intelligence and comparing them with the item difficulty, and identifying the range of scores and the extremity of the ability positively and negatively on each item of the shortened version of the scale. The extent to which the scale items are concerned with any of the latent traits and the extent of bias in the product construction for those high or low on the latent trait.
9. Using the Latent Profile Analysis method to form homogeneous groups within the persons retained in the analysis after the separation of persons and items, and dividing them into groups in light of the resulting fit indices Entropy (Accepted fitted as 0.80 or more), the AIC information index with an acceptable value approximated to zero, the BIC Bayesian information index with an acceptable value approaching zero, the CAIC consistent AIC index, and the SABIC sample-size adjusted BIC index with acceptable values approaching zero. The highest value in the Entropy index is the optimal value for the number of classifications that can be taken.
10. Performing the discriminant function for selecting the group with high emotional intelligence as the focal group and conducting the Non-uniform DIF for ordinal data analysis.

Results:

Unidimensionality and Local dependence:

The study verified the second-order confirmatory factor model to ensure unidimensionality (testing the four-factor model on a general second-order factor), similar to the study by Jacobs et al. (2015). The validity of the second-order general factor model was confirmed, although there were correlations among pairs of residual errors that needed to be adjusted to improve the model fit indicators. The fit indices were SRMR = .092, RMSEA = .058, CFI = .907, and RNI = .907, indicating acceptable fit. Figure 1 shows the structure of the second-order general factor model.

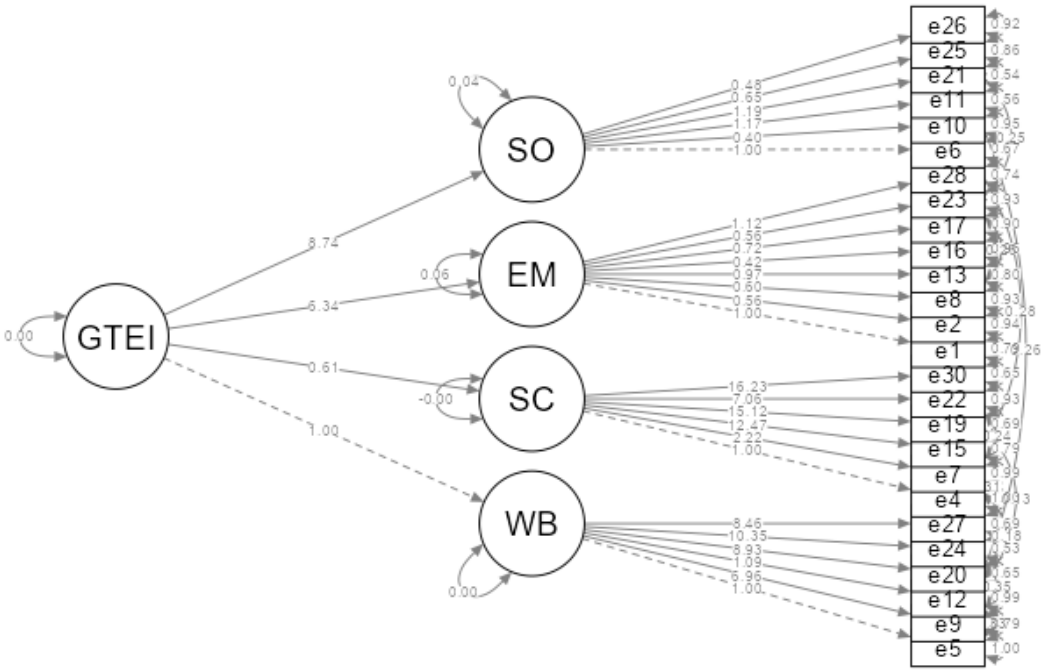

Figure 1The second- order four- factor model of trait emotional intelligence.

The results of the analysis confirmed the condition of unidimensionality. However, there was a concern related to the condition of local dependency, as the items of the scale exhibited dependency. This issue was addressed by introducing correlations between residual errors. It was not possible to produce a Bifactor model due to the negative matrix determinant generated by the data during the analysis.

Item Fit Indices:

These include the Infit and Outfit Mean Square (MNSQ) indices. The Infit MNSQ index relates to the sensitivity of the measure to unexpected responses near the person's ability level. An Infit value exceeding the acceptable range of 1.5 suggests that the item's wording may be confusing, complex, include multiple meanings, or contain negations, potentially leading to incorrect or reversed understanding by the respondent.

The Outfit MNSQ index which is sensitive to unexpected responses across the entire ability scale. Values higher than 1.5 indicate item misfit, suggesting that the item does not belong to the measured construct or assesses a different construct than the rest of the items on the scale. Table 1 provides a summary of the items

separation that do not align with the measured construct or cause ambiguity, thus not reflecting the measured trait accurately.

Table1. Thresholds and item fit indices after item separation.

Items	Measure	S.E. measure	Infit	Outfit
1	.504	.058	.729	.729
2	.210	.054	.907	.907
3	-.037	.056	1.294	1.294
4	.088	.054	.850	.850
5	.298	.054	.719	.719
6	-.493	.071	1.467	1.467
7	.242	.054	1.147	1.147
8	.236	.054	.806	.806
10	.199	.053	.685	.685
11	-.101	.057	1.243	1.243
12	.298	.054	.701	.701
13	-.247	.061	1.285	1.285
14	.339	.055	.759	.759
15	.178	.054	1.096	1.096
16	.210	.054	.756	.756
17	.560	.057	.609	.609
18	.129	.054	.841	.841
19	-.137	.058	1.137	1.137
20	-.255	.062	1.338	1.338
21	.093	.054	1.161	1.161
22	.204	.053	1.002	1.002
23	.336	.055	.740	.740
24	-.251	.061	1.417	1.417
25	.073	.055	.920	.920
26	.178	.054	1.096	1.096
28	.043	.055	1.099	1.099
29	-.107	.057	1.356	1.356
30	-.101	.057	1.322	1.322

Notes. Infit= information- weighted mean square statistic; Outfit= Outfit- sensitive means square statistic.

The study adopts criteria Darmana et al. (2021) that interpret item fit indices, ranging from acceptable values not less than 0.5 and not exceeding 1.5, with the most acceptable values being equal to or upper than 0.7. It is also noted that construct and conceptual validity of the items are achieved as Infit and Outfit indices equated

after items omitted. This indicates that the remaining items, which generally measure emotional intelligence, are reliable indicators for assessing emotional intelligence as traits or emotional self-efficacy. Furthermore, these items accurately reflect emotional self-efficacy, distinguishing emotional intelligence traits considering Petrides' theory.

Regarding the difficulty (threshold) coefficients of the items, it was found to range from -0.493 (moderate difficulty) to 0.560 (high difficulty), with an average difficulty equaled 0.096. This indicates a moderate level of difficulty for the scale items, with a standard deviation of 0.242, suggesting a moderate spread of item difficulties around the mean. The skewness value for the difficulty coefficients was -0.403, indicating a nearly balanced distribution, implying that the items of the scale tend to cluster around moderate difficulty levels. Table 2 presents the descriptive statistics of item difficulty for the Emotional Intelligence Traits subscales.

Table 2. Trait emotional intelligence subscales item separation summary.

	Trait emotional intelligence subscales							
	WB		SC		EM		Soc	
Indices	Thresholds	SE	Thresholds	SE	Thresholds	SE	Thresholds	SE
N of items	4	--	6	--	8	--	10	--
Mean	.023	.058	.079	.055	.232	.056	.027	.057
Median	.024	.058	.133	.054	.223	.055	.083	.055
Mode	.298	.054	-.137	.054	.210	.054	-.493	.054
Std	.318	..04	.162	.002	.256	.003	.230	.005
Min.	-.255	.054	-.137	.053	-.247	.054	-.493	.053
Max.	.298	.062	.242	.058	.560	.061	.339	.071
Skewness	.233	.062	-.611	.900	-.675	1.31	-1.21	2.79
Kurtosis	-6	-5.74	-1.90	-1.18	.771	1.10	2.30	8.27
Shapiro-Wilk (p-value)	.732 (.026)	.782 (.074)	.867 (.216)	.823 (.094)	.943 (.643)	.825 (.053)	.913 (.305)	.604 (.000)

Notes. WB= well-being, SC= Self-control, EM= Emotionality, Soc= Sociability, Thresholds= item difficulty, SE= standard error.

The difficulty coefficients of the Well-being subscale ranged from -0.0255 to 0.298, falling within the moderate difficulty range, with an average difficulty value of 0.023, which is also in the moderate range. The Shapiro-Wilk test for normality provided justification for the non-normal distribution of difficulty coefficients, as they tend to cluster in one region, as depicted in the Q-Q plot. For the Self-control subscale, the difficulty coefficients ranged from -0.137 to 0.242, falling within the moderate difficulty range, with an average difficulty of 0.079, indicating moderate positive values. The Shapiro-Wilk test for the distribution of difficulty coefficients indicated a normal distribution pattern. For the Emotionality subscale, the difficulty coefficients ranged from -0.247 to 0.560, with an average difficulty of 0.232, indicating that the maximum difficulty falls within the high difficulty range. Although the average difficulty value falls within the moderate range, it was evident that items 1 and 17 exhibited high difficulty, indicating that the item measuring emotionality involves

complex emotional aspects. The Shapiro-Wilk test indicated normality in the distribution of difficulty coefficients for the Emotionality subscale.

The difficulty coefficients of the Sociability subscale ranged from -0.493 to 0.339, falling within the moderate difficulty range, with an average difficulty of 0.027, which is also within the moderate range. The Shapiro-Wilk test for the Sociability subscale indicated a balanced distribution pattern for the difficulty coefficients.

Person separation fit indices:

Person separation fit indices are indicators of the accuracy and differentiation among individuals assessed using the Emotional Intelligence Scale. The reliability of person separation reached a value of 0.815, which is considered acceptable. Additionally, the MADaQ3 index, representing the median absolute deviation of Q3, was calculated to be 0.091, indicating statistical significance (statistical significance corrected using the Holm test). The program provided indicators of individual differentiation, including the stability indicator of differentiation, which had a value of 0.952. Additionally, the MADaQ3 indicator, which is the mean absolute deviation of responses from the third quartile calculated for the scale data, had a value of 0.091, which is less than 0.6. This suggests the efficiency and quality of the rating scale used to measure emotional intelligence traits among university students in Saudi Arabia. The study conducted a summary of individual indices using the dataset after excluding individuals with unreliable responses or unexpected outliers, as shown in Table 3.

Table 3. Person separation and latent trait indices

	Global TEI score	Latent trait	Infit	Outfit
N	165	165	165	165
Missing	--	--	--	--
Mean	56.2	-.048	.918	.925
Median	58	.031	.935	.935
Std	14.1	.520	.265	.274
Min	29	-3.06	.022	.020
Max	84	.596	1.46	1.49

The average score on the Global TEI (Emotional Intelligence) test was 56.2, with a median value of 58. The standard deviation of individuals' scores on the scale was 14.1, indicating a very high level of variability (deviation from the average), suggesting a wide range of individual differences in emotional intelligence as a general trait within the sample. As for the latent trait, it ranged from -3.06 to 0.596, with a mean of -0.48 and a median of 0.031, indicating that most responses were concentrated around the zero point, both positively and negatively, to the extent of negative skewness for these values. From Table 3, it was observed that the standard deviation of the latent trait was 0.520, falling within the average range (refer to the plot in the Wright map).

The Wright map interpreting mixed indicators of items and individuals' separation:

The Wright map is a graphical tool that visually combines items and individuals to display the results of a Rasch model. It provides a clear overview of the relationship between the individuals and the items included in the assessment. On the Wright map, the vertical axis represents the trait or latent ability being measured. A higher position on this axis indicates a higher level of the measured trait or latent ability (Neumann et al., 2011). Figure 1 illustrates how to interpret the indicators for both items and individuals.

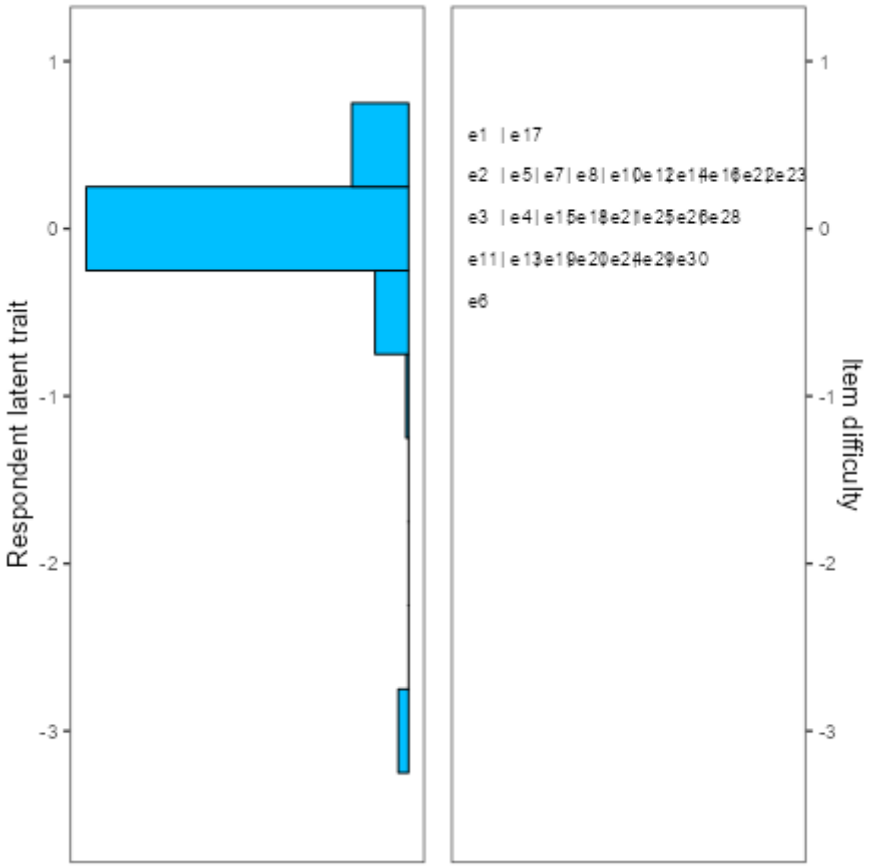

Figure 1. Wright map of person latent trait and item difficulty.

It became apparent that the distribution of moderately difficult items ranged from -0.5 to 0.5, with most items falling within this range except for items 1, 6, and 17. These items were distributed around the latent trait distribution, which centered around the column representing a zero score of latent trait response. This indicates that most items in the sub-scales of the assessment do not adequately challenge respondents with high or low abilities, but rather focus on students with moderate emotional intelligence. Therefore, considering the Wright map distribution, it is evident that the test needs items that challenge individuals with both high and low abilities in emotional intelligence traits.

It was observed from the Wright map that extreme values in response to latent traits were present around the -3 area, indicating a negative skew in scores, suggesting that some items may require refinement or that the Arabic translation provided to university students in the Kingdom of Saudi Arabia may need linguistic review

for clarity in wording or to address ambiguity in some phrases. This is corroborated by the Differential Item Functioning (DIF) discriminative validity scores in the current study's results in Table 5.

Normative profile analysis for emotional intelligence as general traits:

In psychological and clinical health research, researchers rely on classification through cutoff points, which can sometimes be biased. This is because the available sample or random samples to which psychological and emotional measures are applied may exhibit one group over the other in a trait, such as females showing more emotion than males, for example. There's a concern in psychology and psychological health research that the cutoff points adopted by the researcher may divide samples into internally heterogeneous traits within the same group, as in classifications based on the mean, median, or one of the percentile values (25% or 75%). Furthermore, positive or negative skewness will significantly impact the resulting groups subjected to a behavior modification program, for example.

The current study adopted the Latent Profile Analysis method to categorize emotional intelligence as general traits (total scale score) into homogeneous groups. Homogeneity in this case means that individuals within each group are similar, excluding differences within the groups. This method is particularly useful in latent trait theory, as it eliminates individual differences within one of the groups in the measurement trait, providing unbiased estimates if the researcher conducts differential item functioning (DIF) analyses for ordinal data in fields such as education, psychology, and other behavioral sciences. Consequently, the differential item functioning is not the result of differences within the groups but rather differences between the groups in the measured characteristics, usually manifested in the wording of the items or their inability to accurately capture the trait for one of the groups. Table 4 presents the latent profile classifications for emotional intelligence as general traits among the sample individuals.

Table 4. Latent profile analysis for persons on the Global trait emotional intelligence scale.

Class	AIC	BIC	CAIC	SABIC	Entropy	Means SE	Variance SE	P
1	1344	1350	1352	1344	1.000	6.53 6.12	107.10 13.01	.286 Not sig.
2	1294	1307	1311	1294	.985	58.02 .82	107.10 13.01	.000 Sig.
3	1298	1387	1331	1298	.388	60.63 1.80	73.42 10.74	.000 Sig
4	1298	1323	1331	1298	.422	60.65 1.82	73.43 10.74	.000 Sig.

Goodness of fit indicators are relied upon to accept the best classification for categories. The reliance on interpreting the number of accepted categories is the least information indicators for this classification. As for the Entropy indicator, the higher its value, the more efficient the number of classification categories are in considering homogeneous individual differences within groups. It is preferable for categories with an Entropy

indicator of 0.80 or higher, as they provide discriminatory power for both emerging groups and internal group members' homogeneity. If there is variation or fluctuation in the values of the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), or Consistent Akaike Information Criterion (CAIC), then classification can rely on the Bayesian Information Criterion (BIC) or Consistent Akaike Information Criterion (CAIC) or use the modified Bayesian Akaike Information Criterion (SABIC) which is immune to data balance or sample size, giving more logical indicators. It is preferred that the total sample size is not less than 100 individuals to conduct LPA to avoid bias in data interpretation.

It became evident from Table 4 that Group One does not provide interpretive value as a cutoff point for separating and selecting individuals characterized by emotional intelligence as general traits. Additionally, its classification value is not statistically significant, meaning it is not useful for separation. Moreover, the two groups are the optimal classification amidst the four categories suggested using statistical software, given that their Entropy indicator exceeded 0.8, providing high diagnostic power. Furthermore, the SABIC indicator is the lowest among those indicators for classifying the two groups, as well as the AIC and BIC information indicators.

Differential item Functioning (DIF):

The Differential item Function, known as the differential item functioning (DIF), was employed to differentiate between the two homogeneous groups generated using latent profile analysis. The Jamovi 2.3.26 program automatically classified the two groups into high and low general emotional intelligence. A new variable was created by modifying the code of the low-group variable, assigning a code of 2 to 0 to make it the focal group, which represents the high emotional intelligence group since the scale distinguishes individuals with emotional intelligence. The Discrimination Function for each of the sub-scales of emotional intelligence traits was estimated separately. The Discrimination Function was estimated using the difNLR::difORD function. Non-uniform DIF was employed for several reasons: there are two homogeneous groups, each with consistent differences across the latent trait spectrum. Additionally, this method has the capability to handle more complex latent traits and considers the interaction between the group and latent traits. Table 5 illustrates the differential item Functioning for the sub-scales of emotional intelligence traits.

Table 5. Non- uniform DIF for Trait emotional intelligence subscales ordinal data items.

Subscales	Items	X^2	p-value	Adj. P
Well- Being	5	1.34	.513	.513
	12	3.67	.159	.357
	20	3.45	.178	.357
	24	2.19	.335	.447
Self- Control	4	5.08	.079	.329
	7	1.33	.515	.515
	15	4.01	.134	.329
	19	3.03	.219	.329
	22	3.25	.197	.329
	30	2.01	.366	.439
Emotionality	1	5.20	.074	.194
	2	1.91	.384	.385
	8	2.72	.256	.385
	13	1.91	.385	.385
	16	6.82	.033	.194
	17	4.67	.097	.194
	23	5.34	.069	.194
	28	2.03	.363	.385
Sociability	3	.79	.674	.704
	6	6.00	.050	.166
	10	8.30	.016	.079
	11	1.41	.494	.663
	14	12.58	.002	.019
	18	4.93	.085	.212
	21	.70	.704	.704
	25	3.61	.165	.304
	26	3.40	.182	.304
	29	1.27	.530	.663

The results from the table yielded a value for the Chi-square which provides a measure of the weighted discriminatory power of the items and the extent of their significance through the p-value. Also, the corrected significance value from the impact of threshold differences, as the scale relies on a Likert pentagon in the respondents' response to the scale. All items came out non-significant from the corrected threshold effect, statistically speaking. This implies that the items exhibit no differences between the two groups (high and low emotional intelligence as general traits), except for item 14, which belongs to the Sociability subscale.

Upon reviewing the formulation of this item, it became apparent that it refers to adaptation and coping with external circumstances. It's a vague and ambiguously formulated phrase, which may have interpretations

differing between the groups being distinguished (high and low emotional intelligence in the sub-scale of social adaptability). This item requires the researcher, particularly in the field of psychology or mental health, to exercise precision, either by excluding this phrase or by reformulating it accurately to differentiate between the social aspects in a way understood by both groups.

Discussion:

The study aimed to verify the psychometric properties of the Emotional Intelligence Traits Scale by Petrides and Furnham (2001), which was translated and standardized in the Saudi Arabian context by Alenezi et al. (2024). The scale, in its original form, consists of 30 items. Arabic studies encountered some issues with this scale, such as poor matching indicators, indicating potential bias in the trait, or ambiguity in the construct of measuring emotional latent traits, or perhaps due to the construct's inability to estimate emotional self-efficacy accurately. However, the scale demonstrates convergent validity, showing a high degree of validity and stability across different environments. The scale also exhibits discriminant validity, especially between genders and different specialties.

The study represents a new contribution in this field as it sheds light on the items of the scale in its structure and the extent to which its items can estimate the latent trait. It also reflects the construct and conceptual validity, which became apparent in the alignment of the infit and outfit indicators of the items after removing items 9 and 27 and after removing individuals whose responses were deemed unreliable, unexpected, or random, without reading the scale instructions, or responding in a socially desirable manner, especially considering that the scale reflects emotional self-efficacy in behavioral aspects that may require the respondent to display their response in a socially acceptable or socially desirable manner. Therefore, the removal of such responses from the scale represents an addition. Furthermore, the distribution of the minimum and maximum thresholds for the latent trait was wide with a standard deviation, giving the impression that the latent trait has a broad individual difference range.

The study relied on a cutoff point obtained through Latent Profile Analysis (LPA) as a statistical method that produces homogeneous classification categories within individuals. Therefore, the discriminant function between performance on items for the groups highlights the individual differences resulting from the distinctions between the groups, considering that the LPA method adjusts individual differences within individuals. It was found that there was one item with discriminant performance between the two groups, namely item 14. The conclusion drawn from this study is that emotional traits related to self-efficacy receive some ambiguity and doubt in their interpretation because individuals tend to respond in a manner that reflects their self-image in front of others. Moreover, the accuracy in estimating the difficulty of items gives the impression that the scale is suitable for measuring moderate cases of the latent trait of emotional intelligence sub-traits. This necessitates the researcher in education and psychology to formulate items related to high and low emotional aspects capable of accurately sorting cases of high and low emotional intelligence. Additionally, the results obtained from the study indicate the validity and reliability of the scale for application in the Saudi Arabian context and its application to Saudi university students.

Acknowledgement: The research has a fund from the Deanship of Scientific Research at the University of Imam Mohammad ibn Saud Islamic University (IMSIU) on grant number IMSIU- RG 23076.

Availability of data and materials: The datasets produced and analyzed in the present study are not publicly accessible to protect the privacy of the participants. However, interested parties may obtain access to the datasets by contacting the corresponding author and making a reasonable request.

Competing interests: The authors declare no competing interests.

References

Abdel Aziz, A. G., & Moussa, M. A. (2022). Teachers' attitudes and their relationships to bullying behaviors against handicapped students among the inclusion school. *Journal of Special Education & Rehabilitation (2314-8608)*, *14*.

Alenezi, A. K., Alanazi, F. S., Moussa, M. A., & Alnaimi, I. A. (2024). The Trait Emotional Intelligence as An Indicator for Mental Health Within Saudi Society: Assessment Study. *Educational Administration: Theory and Practice*, *30*(5), 10670-10679.

Alharbi, B. A., Ibrahem, U. M., Moussa, M. A., Abdelwahab, S. M., & Diab, H. M. (2022). COVID-19 the gateway for future learning: The impact of online teaching on the future learning environment. *Education Sciences*, *12*(12), 917.

Alharbi, B. A., Ibrahem, U. M., Moussa, M. M., Alrashidy, M. A., Abdelwahab, S. M., Radi, B. A., & Diab, H. M. (2024). Personal elearning management in the context of COVID-19 among university students in Saudi Arabia. *African Journal of Reproductive Health*, *28*(4), 111- 126. DOI: 10.29063/ajrh2024/v28i4.11.

Ali Moussa, M., & Khretan Alenezi, A. (2022). Predictive Accuracy of Social Comparison, Five Big Factors of Personality on Mood Contagion among Social Networking Users of Universities students. *European Online Journal of Natural and Social Sciences*, *11*(3), pp-470.

An, X., & Yung, Y. F. (2014). Item response theory: What it is and how you can use the IRT procedure to apply it. *SAS Institute Inc*, *10*(4), 364-2014.

Baker, J. P., & Berenbaum, H. (2007). Emotional approach and problem-focused coping: A comparison of potentially adaptive strategies. *Cognition and Emotion, 21*(1), 95–118. https://doi.org/10.1080/02699930600562276

Cai, L., Choi, K., Hansen, M., & Harrell, L. (2016). Item response theory. *Annual Review of Statistics and Its Application*, *3*, 297-321. https://doi.org/10.1146/annurev-statistics-041715-033702

Darmana, A., Sutiani, A., Nasution, H. A., Ismanisa, I., & Nurhaswinda, N. (2021). Analysis of RASCH model for the validation of chemistry national exam instruments. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, *9*(3), 329-345.

Harvey, R. J., & Hammer, A. L. (1999). Item response theory. *The Counseling Psychologist*, *27*(3), 353-383. https://doi.org/10.1177/0011000099273004

Lang, J. W., & Tay, L. (2021). The science and practice of item response theory in organizations. *Annual*

Review of Organizational Psychology and Organizational Behavior, *8*, 311-338. https://doi.org/10.1146/annurev-orgpsych-012420-061705

Moussa, M. A. (2021). Assessing the construct and convergent validity of Trait Meta-Mood Scale among Suez Canal university students during corona pandemic. Ismailia college of Education, 49, 2, 19- 32.

Neumann, I., Neumann, K., & Nehm, R. (2011). Evaluating instrument quality in science education: Rasch-based analyses of a nature of science test. *International Journal of Science Education*, *33*(10), 1373-1405.

Orhan, A. (2024). Trait emotional intelligence questionnaire short form (teique-sf): Reliability generalization meta-analysis. *Personality and Individual Differences*, *224*, 112633.

Petrides, K. V. (2010). Trait emotional intelligence theory. *Industrial and organizational psychology*, *3*(2), 136-139.

Petrides, K. V., & Furnham A. J. (2001) Trait emotional intelligence: Psychometric investigation with reference to established trait taxonomies. 15: 425-448.

Petrides, K. V., Furnham, A., & Mavroveli, S. (2007). Trait emotional intelligence: Moving forward in the field of EI. *Emotional intelligence: Knowns and unknowns*, *4*, 151-166.

Petrides, K. V., Mikolajczak, M., Mavroveli, S., Sanchez-Ruiz, M. J., Furnham, A., & Pérez-González, J. C. (2016). Developments in trait emotional intelligence research. *Emotion review*, *8*(4), 335-341.

Reise, S. P., & Waller, N. G. (2009). Item response theory and clinical measurement. *Annual review of clinical psychology*, *5*, 27-48. https://doi.org/10.1146/annurev.clinpsy.032408.153553

Siegling, A. B., Saklofske, D. H., & Petrides, K. V. (2015). Measures of ability and trait emotional intelligence. *Measures of personality and social psychological constructs*, 381-414.

Stanton, A. L., Danoff-Burg, S., Cameron, C. L., & Ellis, A. P. (1994). Coping through emotional approach: Problems of conceptualizaton and confounding. *Journal of Personality and Social Psychology, 66*(2), 350–362. https://doi.org/10.1037/0022-3514.66.2.350

Appendix 1.

Trait Emotional intelligence scale (Short form):

1. I have no problem expressing my feelings in words.
2. I often find it difficult to see things from someone else's perspective.
3. In general, I am a very enthusiastic person.
4. I usually cannot control my emotions.
5. Truthfully, life does not seem enjoyable to me.
6. I can handle people.
7. I change my mind frequently.
8. I often don't know what I'm feeling.
9. I feel I have many strengths.
10. I often have difficulty standing up for my rights.
11. I can usually influence how others feel.
12. Truthfully, my outlook on most things is pessimistic.
13. My loved ones often complain that I don't treat them well.
14. I often have difficulty adapting to external circumstances.
15. I basically know how to handle stress.
16. I often have difficulty showing affection to my loved ones.
17. I can usually put myself in others' shoes and feel the same emotions.
18. I find it difficult to motivate myself.
19. I usually find a way to control my emotions if I want to.
20. Overall, I am satisfied with my life.
21. I consider myself a good negotiator.
22. I tend to get involved in things I later wish to withdraw from.
23. I often wonder exactly what I'm feeling.
24. I believe I have many strengths.
25. I usually give up even when I know I'm right.
26. I feel I don't have control over others' emotions.
27. Fundamentally, I believe my life will end well.

28. I find it difficult to form relationships even with those close to me.
29. I can usually adapt to a new environment.
30. I can usually relax.

Appendix 2.

Brief Trait Emotional intelligence scale (Short form):

1. I have no problem expressing my feelings in words.
2. I often find it difficult to see things from someone else's perspective.
3. In general, I am a very enthusiastic person.
4. I usually cannot control my emotions.
5. Truthfully, life does not seem enjoyable to me.
6. I can handle people.
7. I change my mind frequently.
8. I often don't know what I'm feeling.
10. I often have difficulty standing up for my rights.
11. I can usually influence how others feel.
12. Truthfully, my outlook on most things is pessimistic.
13. My loved ones often complain that I don't treat them well.
14. I often have difficulty adapting to external circumstances.
15. I basically know how to handle stress.
16. I often have difficulty showing affection to my loved ones.
17. I can usually put myself in others' shoes and feel the same emotions.
18. I find it difficult to motivate myself.
19. I usually find a way to control my emotions if I want to.
20. Overall, I am satisfied with my life.
21. I consider myself a good negotiator.
22. I tend to get involved in things I later wish to withdraw from.
23. I often wonder exactly what I'm feeling.
24. I believe I have many strengths.
25. I usually give up even when I know I'm right.

26. I feel I don't have control over others' emotions.

28. I find it difficult to form relationships even with those close to me.

29. I can usually adapt to a new environment.

30. I can usually relax.