



Research article

An item response theory analysis of the Trait Emotional Intelligence Questionnaire Short-Form (TEIQue-SF) in the workplace

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HIGHLIGHTS

- Trait emotional intelligence (EI) may be measured by 30-items TEIQue-SF.
- Data on Swedish version (972 employed persons) were analyzed using IRT.
- The Swedish TEIQue-SF has similar IRT psychometrics as the English version.
- Like past research, only low and moderate levels of trait EI were adequately captured.

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ABSTRACT

Trait emotional intelligence (EI) predicts important outcomes in the workplace. This study is the first one that reports item and scale functioning in the workplace using item response theory (IRT) analysis of the global 30-item Trait Emotional Intelligence Questionnaire Short-Form (TEIQue-SF). Past IRT research, performed mostly on undergraduate English-speaking students, showed that several items in TEIQue-SF were poorly informative. Data collected in Sweden from 972 employed persons were analyzed. IRT with a graded response model was utilized to analyze items of the global TEIQue-SF scale. As was found in past research, the lowest response category in all items had extreme difficulty threshold parameter values, and only low and moderate levels of latent trait EI were adequately captured, but most items had good values of the discrimination parameters, indicating adequate item informativeness. Four items, which in past research have also shown weak psychometric properties, were poorly informative. To effectively measure trait EI in today's organizations, there is an advantage in using the most informative items to best represent this construct.

1. Introduction

Emotional intelligence (EI) is an important concept in organizational psychology. EI predicts important outcomes in the workplace (Zeidner et al., 2004), such as success in personnel selection and placement, job performance, and job satisfaction. The original distinction in the EI literature is between ability EI and trait EI (Petrides and Furnham, 2000). The model of *ability EI* by Mayer and Salovey (1997) concerns the cognitive processing of emotional information and comprises components of appraisal and expression of emotions, regulation of emotions, and utilization of emotional information in thinking and acting. According to this model, maximum performance tests measure ability EI. In tests of ability EI, people rate the emotional content of various stimuli (e.g., faces) and solve problems involving emotional understanding and

reasoning. According to Petrides (2010) “emotional experience cannot be artificially objectified” (p. 137) and measuring the subjective nature of emotions by maximum performance tests is of “limited scientific utility” (p. 137). An alternative conceptualization is *trait EI*, which is a trait of emotional efficacy (Petrides, 2010, 2011), defined as “a constellation of emotional self-perceptions and dispositions located at the lower levels of personality hierarchies” (Petrides et al., 2007, p. 26). Both conceptualizations of EI include affective content, but they are conceptually and empirically different. The current study is about trait EI. Trait EI has become an increasingly popular construct with applications in the realms of clinics, behavioral genetics, stress and coping, romantic relationships, health, education, and organization (O'Connor et al., 2019).

Trait EI may be measured by the Trait Emotional Intelligence Questionnaire-Full Form (TEIQue-FF) consisting of 153 items and 15

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facets, classified into broad trait EI domains (Petrides et al., 2016), yielding four subscales labeled *well-being* (self-esteem, trait happiness, trait optimism), *self-control* (emotion control, stress management, impulse control), *emotionality* (emotion perception (self and others), emotion expression, relationships, trait empathy), and *sociability* (social awareness, emotion management (others), assertiveness). Two facets – adaptability and self-motivation – are not classified into domains. These feed directly into global trait EI.

The 30-item short form TEIQue-SF was derived by Petrides (2001) from the TEIQue-FF. The TEIQue-SF is composed of two items from each of the 15 facets of the full form. These 30 items have been selected based on their highest correlations with the respective total facet score (Petrides, 2009a; Petrides and Furnham, 2006). In doing so, the scale's constructors ensured broad coverage of the global trait EI construct indicators. Translated versions of either a full or short form to date (2021) exist in 27 languages. The scale's constructors and others who translated into their native languages have mostly focused on the validity of the scale by examining the associations between the TEIQue-SF and other EI scales and related constructs, which only provide limited evidence (Kane, 2013). In most published studies the translated versions of the TEIQue-SF are applied on student samples and assessed by classical test theory analyses (e.g., Feher et al., 2019; Laborde et al., 2016; Perazzo et al., 2020; and Szczygiel et al., 2015). Perazzo et al. and Szczygiel et al. conclude that their respective versions are psychometrically sound and that the score of the global scale (30 items) can be recommended for research and practical use. In contrast, Feher et al. and Laborde et al. conclude that further validation studies are needed in particular contexts and cultures.

In the current study we consider psychometric issues of trait EI, applying the TEIQue-SF in the workplace and using item response theory (IRT). IRT analyses yield unique information on the psychometric properties of a scale, such as the scale items' discrimination and difficulty thresholds. Such information is useful for differentiating responders at specified levels of the latent trait. Only items that adequately differentiate at low through high trait levels arguably reflect the latent trait. Items without this property contribute relatively little to the scale's utility and might be considered for further improving or omitting. We acknowledge, however, that IRT does not capture the entirety of relevant psychometric properties of a measurement instrument, and that psychometric indices are not entirely informative in relation to predictive validity. That is, significant predictive and explanatory insights can sometimes be achieved by items with apparently weak psychometric properties, while items (and instruments) with seemingly optimal psychometric properties may occasionally be practically unusable. (We thank an anonymous reviewer for pointing this out.)

1.1. Previous research

Although there are benefits of IRT over classical methods in developing and improving of psychological scales (De Ayala, 2009), and the TEIQue-SF has been translated and validated across many languages and cultures, only a few studies have investigated item and scale functioning in the TEIQue-SF using IRT. In two studies, Cooper and Petrides (2010), using English versions of the TEIQue-SF, analyzed 30 items with IRT: Study 1 ($N = 1,119$) and Study 2 ($N = 866$). These studies were conducted in a sample of highly educated people, largely university students. In Study 1, all 30 items except Item 25 yielded at least moderate values of the discrimination parameters (see Baker, 2001). The difficulty threshold parameters indicated that mostly low levels of trait EI were captured by the TEIQue-SF items. In addition, for 28 out of the 30 items, the two lowest response categories had difficulty threshold parameter values more than three standard deviations (*SDs*) below the mean. This indicates lower measurement precision for people with very high levels of trait EI. Study 1 used an older version of TEIQue-SF (v. 1.00), while Study 2 used the latest version (v. 1.5, which was translated into Swedish and used in the current study). V. 1.5 comprises four rewritten items (8R, 9,

23, 24, see Table 1). The reason for rewriting was to “align the short form with the current full form of the inventory” (Cooper and Petrides, 2010, p. 453). Using another IRT method, Zampetakis et al. (2011) reanalyzed Cooper and Petrides' data and concluded: “(a) not all items span the trait EI continuum evenly, which may adversely affect the accuracy of measurement and (b) that items with low discrimination parameters provide little information and thus contribute little to reducing the error in trait estimates” (p. 310). In both studies by Cooper and Petrides (2010), the global 30-item scale of the TEIQue-SF was considered as sufficiently unidimensional, that is, essentially measuring one single construct (trait EI).

Other IRT studies on the TEIQue-SF have several limitations. Chiesi et al. (2020) investigated responses on the TEIQue-SF in five cultures (Canada, China, Italy, Lebanon, and Spain). Small female student samples from the respective countries were used and the study focused on general assessment (no parameter values were reported for individual items). Cho et al. (2015) used English-speaking undergraduate students and focused on two different IRT models (a dominance model and an ideal point model, respectively) for analyzing data from different conceptual frameworks – ability EI and trait EI (e.g., TEIQue-SF). To facilitate estimation of item response parameters, they collapsed the seven response alternatives into three. They found six items of the TEIQue-SF to have *very low* (23) and *low* (2R, 7R, 11, 25R, 30 where R indicates a reversed item) values of the discrimination parameter and concluded that EI measures should be revised to include more items at moderate and higher trait levels.

Despite the scale's popularity and its many cross-cultural translations and promising validation studies in applied contexts, among others in the workplace, there are only a few studies, using IRT, on item functioning in the latest version (v. 1.5) of the TEIQue-SF. Our study is the first such study using another language version than the English one, and also the first one using data sampled in the workplace and not among undergraduate students.

As regards the practical relevance of our research, one aspect is acquiring information on the precision of measurement across the entire range of scale scores. In the workplace, such information can be valuable in recruiting staff for specific tasks where a high level of EI is desirable. It may also be used in the future for refining the TEIQue-SF scale by providing a good basis for validation studies. Another aspect is providing the opportunity to select items with particularly good psychometric qualities that cover the most essential content of trait EI. In research as well as applied settings, this information can be valuable for anyone who, due to time and/or resource constraints, can only use a few items.

1.2. The aims

It is scientifically relevant to find out whether items and scales of the TEIQue-SF function well in language versions other than English. Trait EI is powerful in predicting important outcomes in the workplace (Zeidner et al., 2004), but it has not been studied in samples consisting exclusively of employees. The aim of the current study was therefore to assess functioning, at the item and scale level, of the TEIQue-SF in the workplace. We were interested in how well each item discriminates (the *a* parameter) between employees with different levels of trait EI, levels, and the level of the trait EI an employee must possess to respond using each of the scale categories (the *b* parameters). In particular, we were interested in which of the 30 items of the current version of the TEIQue-SF are the most informative in effectively differentiating between employees across different levels of the trait EI.

2. Methods

2.1. Participants and procedure

All data were collected using anonymous online surveys. The invitation to participate included a clear information about the eligibility

Table 1. Item response analysis of the Swedish version of the TEIQue-SF (v. 1.5).

Item	Trait EI domain	λ	S- χ^2 (df)	<i>p</i>	<i>a/s.e.</i>	Discriminative power	<i>b</i> ₁	<i>b</i> ₂	<i>b</i> ₃	<i>b</i> ₄	<i>b</i> ₅	<i>b</i> ₆
20.On the whole, I'm pleased with my life.	Well-being	0.74	208.90 (184)	0.101	1.88/0.11	Very high	-3.70	-2.63	-2.18	-1.46	-0.68	0.45
29.Generally, I'm able to adapt to new environments.	Not classified	0.74	193.63 (172)	0.124	1.85/0.11	Very high	-3.64	-2.83	-2.27	-1.68	-0.81	0.44
12R.On the whole, I have a gloomy perspective on most things.	Well-being	0.71	188.18 (180)	0.323	1.70/0.11	Very high	-4.17	-2.86	-2.09	-1.53	-1.11	-0.05
24.I believe I'm full of personal strengths.	Well-being	0.70	198.84 (205)	0.608	1.65/0.10	High	-3.92	-2.79	-2.02	-1.19	-0.19	1.05
9.I feel that I have a number of good qualities.	Well-being	0.69	242.20 (178)	0.001	1.64/0.10	High	-4.19	-3.24	-2.57	-1.88	-0.86	0.63
27.I generally believe that things will work out fine in my life.	Well-being	0.68	239.63 (192)	0.011	1.57/0.10	High	-4.26	-2.92	-2.23	-1.58	-0.82	0.57
6.I can deal effectively with people.	Sociability	0.66	213.87 (208)	0.375	1.50/0.09	High	-3.69	-2.79	-2.27	-1.35	-0.48	0.96
28R.I find it difficult to bond well even with those close to me.	Emotionality	0.66	211.19 (209)	0.444	1.48/0.10	High	-3.81	-2.76	-1.89	-1.45	-0.99	0.24
3.On the whole, I'm a highly motivated person.	Not classified	0.62	299.48 (221)	<0.001	1.33/0.09	Moderate	-4.52	-2.98	-2.14	-1.33	-0.38	1.05
21.I would describe myself as a good negotiator.	Sociability	0.60	292.03 (271)	0.181	1.27/0.08	Moderate	-3.45	-2.16	-1.29	-0.41	0.64	2.26
19.I'm usually able to find ways to control my emotions when I want to.	Self-control	0.60	231.00 (223)	0.342	1.27/0.09	Moderate	-4.22	-2.92	-2.20	-1.53	-0.71	0.83
1.Expressing my emotions with words is not a problem for me.	Emotionality	0.57	304.54 (245)	0.006	1.19/0.08	Moderate	-3.81	-2.49	-1.95	-1.25	-0.24	1.25
15.On the whole, I'm able to deal with stress.	Self-control	0.57	275.32 (257)	0.206	1.18/0.08	Moderate	-3.87	-2.58	-1.88	-1.12	-0.20	1.66
8R.Many times, I can't figure out what emotion I'm feeling.	Emotionality	0.56	256.66 (235)	0.158	1.15/0.08	Moderate	-4.49	-2.93	-2.15	-1.49	-0.74	0.95
5R.I generally don't find life enjoyable.	Well-being	0.54	339.41 (217)	<0.001	1.10/0.09	Moderate	-3.73	-2.75	-2.22	-1.80	-1.26	0.08
14R.I often find it difficult to adjust my life according to the circumstances.	Not classified	0.54	156.34 (167)	0.712	1.08/0.09	Moderate	-6.89	-4.91	-3.73	-2.72	-1.82	-0.02
16R.I often find it difficult to show my affection to those close to me.	Emotionality	0.51	260.14 (250)	0.316	1.01/0.08	Moderate	-5.06	-3.12	-2.01	-1.38	-0.71	0.86
10R.I often find it difficult to stand up for my rights.	Sociability	0.50	316.40 (270)	0.027	0.99/0.08	Moderate	-4.54	-2.90	-1.57	-0.86	-0.18	1.63
11.I'm usually able to influence the way other people feel.	Sociability	0.50	277.67 (254)	0.147	0.98/0.07	Moderate	-5.05	-3.00	-1.85	-0.34	1.18	3.29
26R.I don't seem to have any power at all over other people's feelings.	Sociability	0.50	213.31 (222)	0.651	0.97/0.08	Moderate	-6.83	-4.45	-3.31	-1.80	-0.56	1.51
18R.I normally find it difficult to keep myself motivated.	Not classified	0.48	293.80 (275)	0.208	0.93/0.07	Moderate	-4.39	-3.09	-1.79	-0.92	-0.16	1.66
17.I'm normally able to "get into someone's shoes" and experience their emotions.	Emotionality	0.47	266.32 (240)	0.117	0.90/0.07	Moderate	-6.84	-3.59	-2.68	-1.86	-0.64	1.54
2R.I often find it difficult to see things from another person's viewpoint.	Emotionality	0.38	243.13 (218)	0.117	0.71/0.07	Moderate	-8.49	-5.58	-4.06	-2.85	-1.55	1.35
13R.Those close to me often complain that I don't treat them right.	Emotionality	0.37	109.59 (112)	0.547	0.68/0.08	Moderate	-9.35	-6.71	-5.61	-4.42	-1.33	
4R.I usually find it difficult to regulate my emotions.	Self-control	0.36	348.68 (279)	0.003	0.67/0.07	Moderate	-6.76	-4.46	-2.76	-1.55	-0.27	2.58
30.Others admire me for being relaxed.	Self-control	0.35	317.37 (301)	0.247	0.63/0.07	Low	-5.47	-3.70	-2.53	-0.88	0.58	2.70
22R.I tend to get involved in things I later wish I could get out of.	Self-control	0.32	330.79 (287)	0.038	0.57/0.07	Low	-7.45	-5.02	-3.11	-1.59	-0.33	2.68
25R.I tend to "back down" even if I know I'm right.	Sociability	0.23	350.52 (298)	0.020	0.40/0.06	Low	-9.86	-6.25	-3.51	-1.37	0.62	4.72
7R.I tend to change my mind frequently.	Self-control	0.16	400.51 (293)	<0.001	0.28/0.06	Very low	-17.58	-9.49	-4.79	-1.36	2.09	8.68
23.I often pause and think about my feelings.	Emotionality	0.12	370.81 (353)	0.247	0.20/0.06	Very low	-13.38	-5.69	-2.01	1.38	5.52	10.76

Note. *N* = 972, λ = standardized factor loading, S- χ^2 (df) = fit statistics, *a* = discrimination parameter. Not informative ≤ 0.24 , Low = 0.25–0.64, Moderate = 0.65–1.34, High = 1.35–1.68, Very high ≥ 1.69 . *b*₁ - *b*₆ = item difficulty threshold parameters. Shadowed *b*_{*i*} values >95 percentiles (1.65). TEIQue-SF items reprinted with permission from "London Psychometric Laboratory - <http://www.psychometriclab.com/>. Klicka eller tryck om du har förtroende för den här länken." >www.psychometriclab.com" by K. V. Petrides. © Copyright K. V. Petrides 1998. All rights reserved.

criteria: an experience of working life and being part-time or full-time employed. Responders were 1,051 working persons, including 344 managers in various Swedish regions and organizations. (To conduct a two-parameter logistic model [2PLM] IRT analysis, the recommended minimum sample size is 500–750 participants for 10–20 items, and 250 participants for 30 items [see [Şahin and Anil, 2017](#), able 4]). This sample was examined regarding the fulfilment of assumptions for the use of multivariate methods, and the data were cleaned and screened prior to further analyses. Less than 1% of the data were missing, in a random pattern. Missing values were replaced by means. In addition, we excluded 79 participants who were identified as multivariate outliers by having high values of the Mahalanobis distance ($p < 0.001$). As a result, the current study sample consisted of 972 participants aged 17–77 years (64% women) with a mean age of 39.5 years ($SD = 13.4$).

Participation in the current study was voluntary, and the questionnaires were anonymous and confidential, as ensured by the data collection procedure used. We confirm that the study complies with all regulations. Ethical approval for this study was granted by University West and Lund University in accordance with ethical guidelines for universities in Sweden. All participants were informed of the nature of the current study and provided consent to participate in accordance with the Declaration of Helsinki.

2.2. TEIQue-SF

The Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF; [Petrides, 2009a; 2009b](#)) consists of a global trait EI scale comprising 15 positively and 15 negatively worded items that are derived from the full form. Responses are marked on a 7-point Likert scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). Responses between these two extremes are not labeled. The higher the score, the higher the location of a respondent on the trait EI continuum. In the current sample, the coefficient alpha reliability for the global TEIQue-SF score was 0.87. Additional descriptive statistics are presented in Table S1 (see Supplementary data).

2.3. Cross-cultural adaptation of the TEIQue-SF from English to Swedish

During 2017–2018, a six-stage translation and adaptation process was used to adapt the TEIQue-SF (v. 1.5) from English to Swedish: forward translation by two different translation agencies, synthesis, back translation, harmonization, cognitive interviews, revisions, and pilot data sampling among 344 managers. This process was made in collaboration with the TEIQue-SF developer, K. V. Petrides, Professor of Psychology and Psychometrics at University College London. The Swedish version can be found here (<https://psychometriclab.com/translations-of-teique/>). Details of the translation procedure may be obtained from the authors. The Swedish version of this scale was successfully validated, controlled for desirable responding, against similar EI measures, personality traits, empathy, work engagement, perceived stress, coping resources, and individual work performance ([Dåderman et al., 2019](#)), as well as against personality traits and individual work performance ([Hjälmarsson and Dåderman, 2020](#)). In these studies, the coefficient alpha reliability for the global TEIQue-SF score varied between 0.80 and 0.86, which converges with internal reliabilities reported in validation studies by [Petrides \(2009b\)](#) and [Petrides et al. \(2010\)](#). However, reliability analyses by [Hjälmarsson and Dåderman \(2020\)](#) indicated that several TEIQue-SF items (13R, 22R, 23, 25R) possessed poor psychometric properties in terms of low (0.11–0.17) item-total correlations with the global trait EI scale score.

2.4. Statistical analyses

2.4.1. Godness of fit and unidimensionality

Before applying a unidimensional IRT model to a scale, it is prudent to evaluate the basic assumption of unidimensionality, defined as the scale

items measuring essentially only one trait. However, this assumption does not have to be strictly met, and [Reckase \(1979\)](#) found that one dominant factor substantially influencing item responses is sufficient for proceeding with the analyses. The most commonly used indicators that support the unidimensionality assumption include: (a) the first factor accounting for at least 20% of the variance ([Reckase, 1979](#)); or (b) a ratio >3 between the eigenvalues of the first and the second factor ([Morizot et al., 2007](#)); or good fit of the unidimensional model as assessed by confirmatory factor analysis (CFA).

To ensure that the global trait EI scale and its four domain subscales met the IRT assumption of unidimensionality, EFAs were conducted on all the 30 items. Also, as IRT studies on the domain scales may become of interest (cf. [Cho et al., 2015](#)), EFAs were conducted separately on the items of each of the four domains.

2.4.2. Item response theory

The 2PLM IRT analyses were conducted using IRTPRO v. 4.2, and in accordance with the TEIQue-SF's seven response categories (1–7), a graded response model (GRM; [Samejima, 2016](#)) was selected. A key assumption of the GRM is that scores for each item are ordered consistently across items, such that the lowest response category (labeled as *completely disagree*) is indicative of the lowest level of θ (where θ indicates different levels of the trait EI). The GRM estimates a common item discrimination parameter for each item (a), and also estimates the location of the difficulty threshold parameter (b_i) for each response category within the item ([Penfield, 2014](#)). Each item of the TEIQue-SF has an average a value across 7 response categories. A higher a value indicates that an item discriminates more precisely between respondents with different levels of θ . Each item was evaluated in terms of its function relative to the other items, which was assessed by both its scale score and its contribution to the overall information gathered from each scale score ([Baker, 2001](#)). In Table 1, items are ranked by their a values.

The number of threshold parameters per item is the number of response options minus 1. The TEIQue-SF thereby has six difficulty threshold parameters (b_1 – b_6). The threshold parameter (b_i) indicates the level (θ) of the *latent trait EI* that a respondent must possess to respond using the corresponding response category. For these analyses, b_6 indicates the θ level at which responses of *agree* (the verbal equivalent of the numerical response of 6) and *completely agree* (the response of 7) are equally likely. Consequently, b_6 is most typically observed at high levels of θ , b_4 at moderate levels, and b_1 at low levels. Difficulty threshold parameters b_i are expressed in SD units from the mean value 0, that is, the fixed average latent trait EI level. Scale items with b values outside of the range -3 to $+3$ may be problematic and this could be due to either inappropriate phrasing or less useful response categories. When assessing the location of threshold parameters, it is a good idea to examine whether the trait EI values for b_1 , b_2 , b_3 , b_4 , b_5 , and b_6 are evenly spaced, with b_1 , b_2 , and b_3 well below the mean of zero, b_4 close to the mean, and b_5 and b_6 above it.

2.4.3. An inspection of item characteristic curves

Both discrimination and difficulty threshold parameters can be represented graphically as item characteristic curves (ICCs). An ICC depicts the likelihood of a response in a given category to an individual item as a function of the trait level (θ) as reflected by the TEIQue-SF scale. ICCs typically cover the θ range from -3 to $+3$. In the current study, an item's ICCs help to indicate how much information is provided by that item in different ranges of the trait EI distribution. ICCs were fitted for each response category of each item using a nonparametric IRT model without any a priori specification of the order of the responses. We examined the ICCs to determine which response categories were empirically associated with lower and higher trait levels. An *item information function* (IIF) was then produced for each item, indicating the measurement accuracy as a function of θ ([Hambleton and Jones, 1993](#)). Finally, in line with common IRT procedures, each item's IIF was evaluated, with those items yielding a low, flat IIF (i.e., not gathering much information at any trait level) being

classified as low informative or low functioning items. Items with $a \geq 0.65$ for which each ICC occupied a distinct θ value, as well as those that yielded information curves that were not flat were deemed more informative.

3. Results and discussion

3.1. Descriptive statistics and unidimensionality check

Table S1 and Comment 1 (Supplementary data) present descriptive statistics of the Swedish version of the TEIQue-SF, for the global scale score and separately for its four domain specific subscale scores calculated according to the manual (Petrides, 2009b). We found a dominant factor (accounting for at least 20% of the variance) for the whole questionnaire as well as for each of its four domains (Table S1), and this result was considered, as in Cho et al. (2015), to meet the criterion for “good enough” unidimensionality (see also Comment 2, Supplementary data).

3.2. Testing item and scale functioning

Samejima's et al. (1969) GRM model was tested, and the supplementary fit statistics indicated an acceptable/adequate fit considering the large sample size ($M_2 = 1112.41$, $df = 256$, $p < 0.001$; RMSEA = 0.06) (Maydeu-Olivares and Joe, 2006). Only three items (3, 5R, 7R) showed significant values ($p < 0.001$) of local dependence, $S-\chi^2$ (Table 1), thereby indicating that almost all items fit under the graded unidimensional model, proposed by Chen and Thissen (1997).

Table 1 shows that values of the discrimination parameter a ranged from 0.20 to 1.88. Following the rules of Baker (2001), about 25% of the items were classified as *very high* or *high* in terms of discriminative power, but most of them as *moderate*. Five out of the six items of the well-being domain (dispositional positive affect) were classified as *very high*, whereas one remained *moderate*. Two items (7R, 23) were classified as *very low*, and three others (22R, 25R, 30) as *low*. Most of these poorly informative items were from the domain of self-control (e.g., low impulsiveness). This finding indicates that the items concerning

well-being were able to differentiate employees according to their levels of trait EI, while items concerning self-control were not.

Theoretically, trait EI is a constellation of emotional dispositions and self-perceptions of personality focusing on affect-related aspects. Therefore, it is not surprising that items indicating well-being were particularly informative. Well-being is generally expressed in high levels of life satisfaction, low self-perceived stress, and somatic complains. Note, however, that trait EI theory (Petrides, 2010, 2011) aims to organize all possible affectively related personality traits into a unidimensional framework. Based on this theory, our findings suggest a rather unsatisfactory balance in terms of discriminative power among items assessing different domains of trait EI as operationalized by the global TEIQue-SF scale. It might be inaccurate to assume that all items in this scale adequately capture the global concept of trait EI, at least among employed persons in Sweden. All items had values of b_1 (corresponding to the lowest response category) below -3 . In addition, the parameters b_1 to b_5 were generally negatively signed, indicating that employed persons low on trait EI were still using high response categories (5–7) when responding to the items of the TEIQue-SF. This finding is in line with past research (Cooper and Petrides, 2010), indicating that items are formulated too “easy.” Still, the TEIQue-SF comprises 50% of negatively worded items. This preference for choosing high response categories may also indicate a tendency of social desirability in responding. Negative wording may not be enough to make the items indicating trait EI sufficiently difficult to endorse, as is also the case with items indicating other personality traits commonly perceived as socially desirable (e.g., self-esteem, empathy). Using negatively worded items may influence the measured construct's content validity. This may be a real issue in the current study as there is only a moderate correlation ($r = 0.45$) between the positively and negatively worded items (see Additional analyses, Supplementary data).

Item characteristic curves (ICCs, colored lines), combined with item information functions (IIFs, dashed lines) are presented in Figure 1. Four observations can be made on the IIFs: (1) Seven items (10R, 11, 15, 17, 18R, 21, 26R) provide less information than others but follow similar rank orders in terms of amount of information. These items adequately measured trait EI from low to high levels. (2) Eight items (6, 9, 12R, 20,

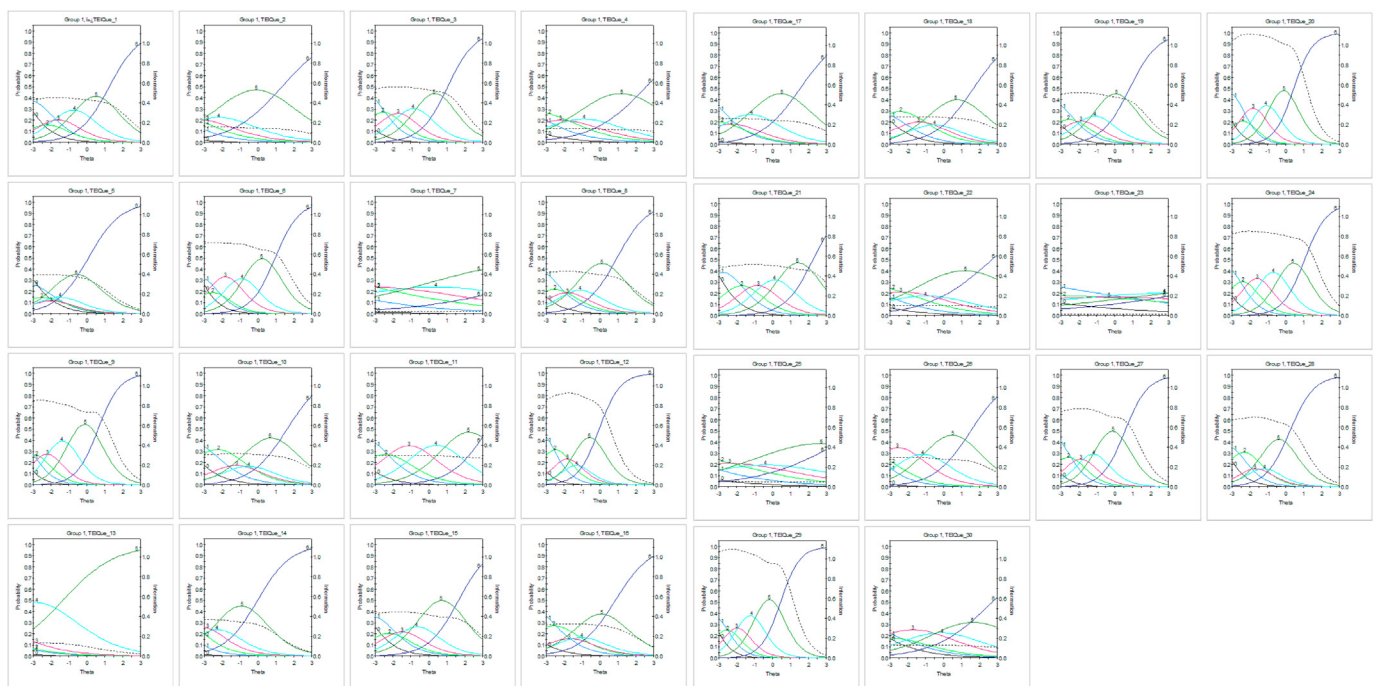


Figure 1. Item Characteristic Curves (ICCs, colored lines), Combined with Item Information Functions (IIFs, dashed lines) for all 30 Items in the Swedish Version of the TEIQue-SF (v. 1.5).

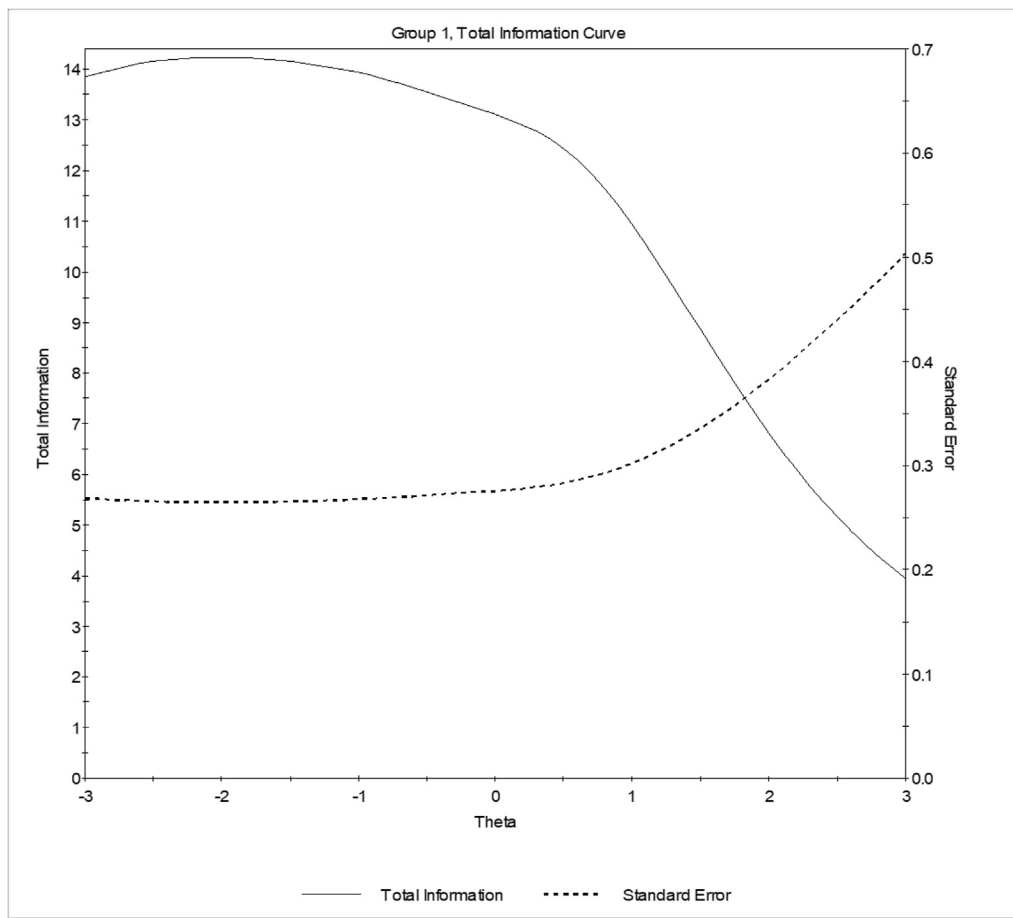


Figure 2. Test Information Function (TIF) of the Swedish Version of the TEIQue-SF (v. 1.5) under the Graded Response Model (GRM). Note. Latent trait θ is shown on the horizontal axis, and the amount of information and the standard error yielded by the test at any trait level is shown on the vertical axis. In the θ range from -3 to about 1.8, the amount of test information was at least 7.4 (which yields a standard error of estimate about 0.36). We can interpret the information magnitude by computing the associated reliability ($r = 1 - 1/\text{information}$). Thus, reliability was equal to or greater than 0.85 within the range described.

24, 27, 28R, 29) provide the most information for people with trait EI around $\theta = -2$. This finding replicates past research (e.g., Cooper and Petrides, 2010; Zampetakis, 2011) in that the 30-item TEIQue-SF scale can be used to measure trait EI accurately at lower levels of trait EI. It will be problematic when almost 25% of items do not span the trait EI continuum evenly, because these items may lower the reliability of the scale, especially at higher levels of trait EI where the standard error increases (see Figure 2). (3) Five items (7R, 13R, 22R, 23, 30) provide overall poor information. Based on Item Response Theory only, these items yield zero information on global trait EI as measured by TEIQue-SF, but it is possible that this kind of items may fulfil other functions in studies. For example, Item 7R (I tend to change my mind frequently) may appear very odd to employed persons who are expecting to follow specific regulations and organizational goals. Also, Item 23 (I often pause and think about my feelings) may appear odd to employees in today's often fast-paced organisations. It may be noted that Items 7R and 23 stand out among other items showing numerically large values of b_1 , b_2 , as well as b_6 . (4) Eight items (5R, 9, 12R, 14R, 20, 27, 28R, 29) are too "easy", that is endorsing higher response categories requires too low levels of the latent trait EI, and provide almost zero information for people scoring above 2.5 SDs of the θ mean.

A couple of observations also may be made regarding ICCs: (1) Only on Items 11 and 21 are responses evenly chosen by responders with low as well as high levels of trait EI. (2) For most items the point at which a respondent has a probability of 50% to respond with the response category 6 is positioned 3 SDs above the θ mean (see the blue line No. 6).

To summarize, we found that the Swedish version of this scale adequately measured trait EI ranging from low to quite moderate levels, whereas it was less precise for the highest levels of the trait (see Figure 2).

This is in line with IRT research by Cooper and Petrides (2010) on the 30-item global scale of the English version of the TEIQue-SF, as well as by Cho and colleagues (Cho et al., 2015) on this and other EI measures. Concerning specific reliability, the test information function (TIF), shown in Figure 2, indicated that the scale was sufficiently informative for a broad range of the trait EI but that it was most informative on its low levels. An examination of Figure 2 shows that at higher trait EI scores the standard error increased, indicating less measurement precision for those with very high levels of trait EI.

4. Conclusions

To investigate whether this short form of a scale reliably measures trait EI among employed persons, we investigated the psychometric properties of the 30-item TEIQue-SF in the workplace and in another language version than English, namely, Swedish, using IRT. This study focused on the functioning of individual items. According to De Ayala (2009) most of the items of the global scale (same as was used in the current study) possess adequate discriminative power ($\alpha = 0.80\text{--}2.25$) and may thereby distinguish between employed persons with different levels of trait EI. Our results agree with this in that most items had satisfactory values of the discrimination and difficulty threshold parameters as well as high/moderate item information values. Our findings (Table 1) are also in line with those of Cooper and Petrides (2010) as well as with the conclusions of Cho et al. (2015) regarding the English version of the TEIQue-SF. Similarly as for this version, we found that only low and moderate levels of latent trait EI were adequately captured.

Four items, which in past research showed poor psychometric properties, were poorly informative. Our results for these items (7R, 23, 25R,

30) were in line with IRT analyses of Cho et al., who classified them as *low* in discriminative power (Item 23 *very low*). They also agree with results of Cooper and Petrides, who found Item 23 to possess a *poor* discriminative power, and with those of Zampetakis et al. (2011) who used another method (unfolding IRT), to reexamine Cooper and Petrides' data and classified 24 items as *low*, and three items (7R, 23, 25R) as *very low*.

Based on analyses using Item Response Theory, we conclude that the Swedish version of the TEIQue-SF, completed by employed persons from different Swedish workplaces, possesses similar psychometric properties as the English version, in terms of its strengths as well as its weaknesses.

Declarations

Author contribution statement

Anna Maria Dåderman : Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Petri J. Kajonius : Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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