

Exploratory Factor Analysis of the Mental Toughness Assessment- Long Form

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Summarized extract from Perez (2021)

Participants

Data were collected from participants who self-selected to take on an online survey on mental toughness.

Materials

The 45 self-report items from the original long version of the Mental Toughness Assessment (MTA) rated the extent to which participants felt the statement related to them. Example items include: “Overall, I expect more good things to happen to me than bad”, “When bad things happen to me, I don’t get despondent”, and “I don’t mind working outside my comfort zone.” Responses were on a Likert-type scale, ranging from 1 = “Does not resonate at all” to 10 = “Strongly resonates with me”. The 45-item version of the MTA was administered, however this analysis focused only on the eight larger factors/items (i.e., authenticity, emotional intelligence, positive attitude, confidence, grit, resilience, good judgement, motivation) that are composed of the 45-items.

Procedures

Participants completed an online questionnaire with 45 items reflecting Mental Toughness.

Results

Data Screening

The data was screened for univariate outliers, duplicates, and missing pieces of information. Duplicate cases, due to administrative and technological error, were identified and removed to account for possible practice effects. The minimum amount of data for factor analysis was satisfied, with a final sample size of $N = 13,279$ participants, providing a ratio of over 295 cases per variable. The eight dimensions demonstrated good internal reliability based on Cronbach's alpha of .84.

Factor Analysis

As an initial step, the factorability of the eight dimensions were first assessed using Exploratory Factor Analysis (EFA). Specifically, a common factor analysis was used to test the underlying factor structure of the MTA on one third of the overall sample ($n = 4,426$). The remaining sample ($n = 8,853$) was used for the subsequent Confirmatory Factor Analysis (CFA).

Exploratory Factor Analysis. Several well-recognized assumptions were met to test the factorability of the MTA. First, it was observed that all eight items correlated at least .3 with at least one other item, suggesting reasonable factorability. Second, the Kaiser-Meyer-Olkin measure of sampling adequacy was .71, above the commonly recommended value of .6, and Bartlett's test of sphericity was significant ($\chi^2(28) = 52,769.26, p < .001$). Given these overall indicators, factor analysis was deemed to be suitable with all eight items.

An EFA was used because the primary purpose was to assess dimensionality and improve scientific parsimony. Furthermore, an additional goal was to utilize a data reduction technique to develop a short version of the MTA. Based on promax factor rotation, the first two factors had eigenvalues greater than one and explained 45% and 22% of the variance respectively for a total of 67%. The third factor explained an additional 11%; however, the third factor had an eigenvalue of .87. The two-factor solution, which explained 67% of the variance, was suggested because of the 'leveling off' of eigenvalues on the scree plot after two factors. For factor one, positive attitude (.96), confidence (.62), grit (.57), resilience (.56), good judgement (.96), and motivation (.62) loaded more strongly than onto factor two. For factor two, authenticity and emotional intelligence had the highest factor loadings with factor loadings of .89 and .89 respectively. However, the factor loadings for factor one possibly indicates a third factor. A confirmatory factor analysis was subsequently conducted to confirm whether two or three factors underlie the assessment data.

Confirmatory Factor Analysis. A confirmatory factor analysis was conducted with the remaining sample ($n = 8,853$). Based on the prior EFA, a hypothesized multidimensional factor structure was tested on two latent factors. Factor one consisted of authenticity and emotional intelligence and was theorized to be a latent factor tapping into aspects of self-regulation and interpersonal relationships. Examples include: "I respond to others to build strong relationships" and "I am satisfied with the relationships I have with my friends." Factor two consisted of positive attitude, confidence, grit, resilience, good judgement, and motivation. The two factors were correlated to test the hypothesized multidimensional factor structure. Based on modification indices, items within the second factor were correlated with each other to achieve good fit. Results suggested good model fit for the overall factor structure ($\chi^2(14) = 708.63, p < .001$; RMSEA= .075; CFI= .986; SRMR= .023). A third factor structure was also tested. This factor structure was not able to converge. Ultimately, the data supports a two-factor structure with the use of the long version of the Mental Toughness Assessment.

Development of the MTA-Shortened Version. Mental toughness is a broad psychological construct that reflects more distinct psychological resources such as self-efficacy, mastery, adaptability, problem solving, and positive attitude, grit, resilience, and perseverance. A theory-driven approach was then taken to reduce the number of items of the original MTA in order to develop a 30-item version of the MTA for the purpose of further psychometric testing. These 30 items were selected based on their face validity, i.e., the extent to which the statement appears to reflect the concept it is meant to measure. An example of an item from the MTA and its relevant psychological resource is as follows: "mental toughness is believing you will prevail in your circumstances rather than believing your circumstances will change." This statement reflects the concept of **self-efficacy**, the belief that you can influence events that affect your life (Bandura, 1977). On a broader level, the MTA is meant to measure the extent to which people feel they have control and influence over what happens to them. Those who rate low in mental toughness feel that things happen to them and that there is very little they can do to change them. This

reflects the concept of **mastery**, an internalized, generalized expectation that one can exert influence on their environment through their choices and actions. Moreover, it is the idea that people can be agentic in creating change as opposed to events being fatalistically determined (Pearlin et al., 1981; Pearlin & Schooler, 1978). MTA is also meant to reflect the extent to which people believe that challenges, problems, and change are opportunities and will actively find ways to move past the roadblocks that show up in life. Those ranking low in mental toughness see challenges, problems, and change as stress and respond negatively to things they don't like or are new. This reflects the concepts of **adaptability, problem solving, and positive attitude**. Furthermore, people who rate high in mental toughness have the confidence and persistence to move forward when confronted with difficult tasks. Those who rate lower in mental toughness have more self-limiting beliefs about their abilities and have a hard time dealing with setbacks. This reflects the concepts of **grit, resilience, and perseverance** (Duckworth et al., 2007).

Discussion (Key Points)

A two-factor structure for the eight larger dimensions of the 45 items was evident based on the Exploratory Factor Analysis using promax rotation.

A two-factor structure was also suggested based on the Confirmatory Factor Analysis.

Clarity and parsimony could be strengthened by examining factor structures based on item-level data.

The Mental Toughness Assessment scale demonstrated good reliability with a Cronbach's alpha of .84.

References

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