Factor Analysis Indicates Resilience as an Aspect of Meta-Mood Experience

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Abstract

The Trait Meta-Mood Scale (TMMS; Salovey et al., 1995) is a self-report measure of meta-mood that consists of 30 items. The meta-mood experience is the tendency to monitor and regulate ongoing mood states. Originally, 30 items were confirmed to measure the meta-mood experience. These 30 items were then organized into three factors of meta-mood: Attention to Feelings, Clarity of Feelings, and Mood Repair (Salovey et al., 1995). However, Palmer et al. (2003) found that an additional fourth factor can fit into the original TMMS model structure, creating a four-factor model. Previous research has not assessed the goodness of fit for these model structures of the TMMS when only partial information about the data's value is known.

This phenomenon is called censored data (Gijbels, 2010). Censored data may be found on some of the TMMS items which can occur when rating scales fail to distinguish people at one end of the dimension. If unaccounted for, censored data can distort statistical analyses and invalidate conclusions.

The purpose of the present study was to examine whether a one-factor model, Salovey et al.'s three-factor model, or Palmer et al.'s four-factor model fits our sample data the best when we assume participants may have censored values on some TMMS items. In this paper, we explored the fourth factor that Palmer et al. did not interpret, and labeled it Resilience because it measures the ability to maintain a stable emotional outlook. We explored that factor in this paper. We also evaluated the one-factor model that was proposed by Palmer et al., in which all items load onto a general factor that we have labeled Meta-mood.

Our sample (n = 202) consisted of University of Nevada, Las Vegas students who participated in return for course credit. Age, gender, ethnicity, and ability with English were recorded along with the participants' self-reported answers to the TMMS items. The R package lava was used to account for censored data and estimate the factor correlations and item loadings for each factor model using confirmatory factor analysis. Each of these items had a high collection of the lowest possible scores, and the phrasing of these items did not reflect the lowest end of the dimension that they were trying to measure. We calculated Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) statistics in lava to analyze the relative fit of each model. Then we compared AIC and BIC scores and found that Palmer et al.'s four-factor model had the best fit to our sample data.

While analyzing factor structures of the TMMS, no published research has accounted for censored data. The current study replicated and provided additional support for Palmer et al.'s four-factor model of Clarity, Attention, Repair, and the unnamed fourth factor we named Resilience while accounting for censoring. Our findings suggest that researchers using the TMMS could calculate subscales based upon this four-factor model to better capture meta-mood experience. We suggest these subscales exclude weak item-factor loadings. After calculating these subscales, researchers can account for censored values that may be present.

Introduction

People generate emotions as a response to stimuli. Although emotion can be interpreted as a product of human beings, it is also considered a source of information to deal with (Schwarz, 1990). Salovey et al. (1995) defined emotional intelligence as an individual's ability to identify their and others' emotions, regulate their feelings, and use those feelings to motivate adaptive social behavior. Emotional intelligence could have significant consequences for psychological adjustment in coping situations (Extremera et al., 2009). Moreover, emotional intelligence seems to be linked with life satisfaction and task mastery (Martinez-Pons, 1997). Individuals differ in emotional intelligence through the process of realizing ongoing mood-related information and then reflecting on and regulating the information. This is termed the meta-mood experience (Mayer & Gaschke, 1988).

The Trait Meta-Mood Scale (TMMS) is a self-report measure of meta-mood. Created by Salovey et al. (1995), the TMMS was originally composed of 48 items, which they shortened to 30 items (See Table 1). The 30-item version was assessed using confirmatory factor analysis which provided support for a three-factor structure consisting of: Attention to Feelings (Attention), Clarity of Feelings (Clarity), and Mood Repair (Repair). The name of each factor was determined by considering the items that loaded onto it. For example, the highest positively loaded item on Attention to Feelings was "I pay a lot of attention to how I feel" and the highest negatively loaded item was "I don't pay much attention to my feelings." (Salovey et al., 1995).

However, other factor structures of the TMMS have been evaluated. An exploratory principal components factor analysis by Palmer et al. (2003) replicated the three factors found in Salovey et al.'s 30-item version of the TMMS and suggested an additional fourth factor. They then ran a confirmatory factor analysis to assess the fit of the three- and four-factor models. The goodness of fit indices suggested that both Salovey et al. 's (1995) three-factor model and an a four-factor model fit sample data well. Palmer et al. 's (2003) attributed differences in the findings of his study and Salovey et al's (1995) study to variations in the way sub-populations of

different genders, sample sizes, social classes, levels of education, cultures, and other sampling parameters respond to the TMMS. The name of this fourth factor was not interpreted in Palmer et al.'s paper. The two items that solely loaded on this fourth factor were item 9 ("When I am upset, I realize that the 'good things in life' are illusions") and item 14 ("My beliefs and opinions always seem to change depending on how I feel"; Palmer et al., 2003). Considering these two items and all others that load onto the factor comprehensively we decided to name this item Emotional Resilience (Resilience), because the loading items of this factor seem to measure the ability to maintain a stable emotional outlook.

In the same paper where the four-factor model was proposed, a one-factor structure of the TMMS was evaluated but had poor fit (Palmer et al., 2003). Although various factor structures of the TMMS have been evaluated numerous times, no published research has evaluated the TMMS while accounting for censored data.

Data are censored when researchers only have partial information about their value (Gijbels, 2010). Censoring can occur when rating scales fail to distinguish people at one end of the dimension. Left censoring occurs when values at the lower end of a dimension cannot be discerned from values that go below the lower end. For example, imagine there is a scale that measures time spent on the internet. An item that on this scale states "I spend an unreasonable amount of time on the internet." Let us examine the participants that rated this item a one on a five-point scale, indicating they strongly disagree. Although we know participants strongly disagree with this item, their perceptions on how long an excessive amount of time is may vary. A score of one for a particular participant may mean they spend two hours on the internet a day. However, another participant scoring a one on this item may spend six hours on the internet a day. These ratings at the lower end of the dimension would be left-censored because the differences in time spent on the internet cannot be discerned from one another.

It is critically important to correct the effect of censoring on a dataset. If unaccounted for, censored observations could distort statistical analyses and invalidate conclusions. A method to examine for censoring on both the independent and dependent variables is provided by Holst et al. (2015) and has been incorporated in the R package lava. Holst et al. 's (2015). We will be using lava in our study to account for censoring.

There are currently three known factor models that can be applied to items on the TMMS: the one-factor model, three-factor model (Salovey et. al., 1995), and the four-factor model (Palmer et. al., 2003). The fits of these three models have been assessed in previous research, but no study has assessed the goodness of fit while taking censored data into account. Our research aims to compare the three factor structures to find out which one best fits the TMMS, if some participants may have censored values on some items.

Method

The 30 items on the TMMS were administered to 202 UNLV students (137 female, 65 male) online in return for course credit as part of the Psychology Subject Pool. Participants ranged in age from 18 to 49 (M = 22.70 SD = 6.29). One hundred sixteen participants were Caucasian, 32 were Asian, 20 were African American, 20 were Hispanic, 13 identified as other, and 1 was Native American. Participants were also measured on their first language, how many years they've been speaking English, and their comfort speaking English.

Each item on the TMMS included a 5-point rating scale running from 1 (strongly disagree) to 5 (strongly agree). Salovey et al.'s original three-factor model of the TMMS indicated factor loadings on Attention, Clarity, and Repair. Palmer et al.'s four-factor model corresponded to Salovey et al.'s three dimensions and reflected a fourth factor we called Emotional Resilience.

Participants completed the study by taking written assessments and questionnaires on the computer. They were encouraged to use computers in the UNLV computer labs. Measures were administered in two testing sessions. Each session took 1.5 hours, and participants were encouraged to complete the testing sessions on different days to prevent fatigue. Participants in the UNLV Psychology Subject Pool received three research credits for their participation.

To see whether items may contain censored values, we created histograms for the rating scale of each item. A criterion used to indicate left-censoring were items that had a high concentration of scores at the lowest end of the rating scale; but to determine whether these items were left-censored, we considered the phrasing of them. For example, the phrasing of item 3, "I don't think it's worth paying attention to your emotions or moods," indicates that those who strongly disagree may have varying amounts of Attention; some participants may pay attention to their feelings a little bit and some may not pay attention at all. We thus considered item 3 to be left-censored. In addition, we determined that two other items may be left-censored: items 4 ("People would be better off if they felt less and thought more.") and 19 ("I can never tell how I feel."). The same explanation for censoring applies to how item 4 relates to Attention and how item 19 relates to Repair.

After participants answered the TMMS items, we ran confirmatory factor analyses in *lava* on the one-, three-, and four-factor models of the TMMS (See Table 2). Absolute fit indices are not available in *lava* for censored models with ordinal data. Therefore, we examined the fit of the three models to our data by obtaining values for the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). They are relative fit indices used to compare models and determine which one is the best for the data. These fit indices are available in lava when censored values are accounted for. Lower AIC and BIC scores indicate better model fit.

Results

The confirmatory factor analyses in *lava* revealed that Palmer et al.'s four-factor model fit our data best. The four-factor model had the lowest AIC and BIC scores (See Table 3). See Figures 1, 2, and 3 for item-factor loadings and inter-factor correlations for the one-, three-, and four-factor models, respectively.

Discussion

The aim of the present study was to discover whether the one-, three-, or four-factor model had the best fit to our data when censored values on TMMS items were accounted for. No published research has accounted for censored data on the TMMS. With the use of the *lava* package in R, our results supported that Palmer et al.'s four-factor model fit best (See Table 3). The four-factor model included Clarity, Attention, Repair, and a fourth factor. The name of the fourth factor was not described by Palmer et al.; we decided to label it Emotional Resilience because the items that loaded onto the factor were primarily concerned with a steady emotional viewpoint in the face of mood fluctuation.

Limitations of the study are found in participant selection, study design, and data analysis. The demographics of our sample may affect the external validity of the present study. The average age of our sample was 22.70 years old and participants were all college students. The differences in life stage and occupation may result in diverse life experience, thus, different perception in meta-mood. These differences in the sample could potentially result in a different model fit when replicated. A large portion of our sample's ethnicity was Caucasian. An unbalanced composition of participants' ethnicity could have altered responses to TMMS items due to cultural differences. For example, Caucasians may differ in their meta-mood due to their upbringing, social expectations, and social values. This may have changed the fit statistics because of the variation in scoring. To assess fit in the study, we used AIC and BIC. They were the only fit statistics available in *lava* to conduct confirmatory factor analyses while accounting for censored values. AIC and BIC are relative measures of fit, thus, our study included no absolute measures of fit.

The four-factor model fits our data the best compared to the one-factor and three-factor model. This suggests there are four aspects of meta-mood that the TMMS should measure. To comprehensively measure the meta-mood experience, future researchers should calculate scores for four subscales when scoring the TMMS: Attention, Clarity, Repair, and Resilience. The subscale for Resilience should include items 9 ("When I am upset I realize that the 'good things in life' are illusions."), 14 ("My beliefs and opinions always seem to change depending on how I feel."), 19 ("Although I am sometimes happy, I have a mostly pessimistic outlook."), 21("I pay a lot of attention to how I feel."), and 24 ("I often think about my feelings."). This could specify the definition of meta-mood on the scale and help researchers understand the scores of participants and make comparisons.

References

Allignol, A., & Latouche, A. (2020). Survival analysis. *CRAN Task View*. https://cran.r-project.org/web/views/Survival.html

Extremera, N., Durán, A., & Rey, L. (2009). The moderating effect of trait meta-mood and perceived stress on life satisfaction. *Personality and Individual Differences, 47*(2), 116–121. https://doi.org/10.1016/j.paid.2009.02.007

Fernandez-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale. *Psychological Reports, 94*(3), 751–755. https://doi.org/10.2466/pr0.94.3.751-755

Holst, K. K., Budtz-Jørgensen, E., & Knudsen, G. M. (2015). A latent variable model with mixed binary and continuous response variables. https://www.researchgate.net/publication/279864661_A_latent_variable_model_with_mixed_binary_and_continuous_response_variables

Martinez-Pons, M. (1997). The relation of emotional intelligence with selected areas of personal functioning. *Imagination, Cognition and Personality, 17*(1), 3-13. https://doi.org/10.2190/68VD-DFXB-K5AW-PQAY

Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. *Journal of Personality and Social Psychology, 55*(1), 102–111. https://doi.org/10.1037/0022-3514.55.1.102

Palmer, B., Gignac, G., Bates, T., & Stough, C. (2003). Examining the structure of the Trait Meta-Mood Scale. Australian Journal of Psychology, 55, 154-158. https://doi.org/10.1080/00049530420002986l2

Salovey, P., Mayer, J. D., Goldman, S. L., Turvey, C., & Palfai, T. P. (1995). Emotional attention, clarity, and repair: Exploring emotional intelligence using the Trait Meta-Mood Scale. *Emotion, Disclosure, & Health*, 125–154. https://doi.org/10.1037/10182-006

Schwarz, N., & Zentrum, U. (1990). Feelings as information: Informational and motivational functions of affective states. *Handbook of motivation and cognition: Foundations of social behavior, 2*, 527–561.

Table 1

Goodness of Fit Indices for the Three Models

Fit Indices	One-Factor	Three-Factor	Four-Factor
AIC	15085.95	14600.01	14039.43
BIC	15689.80	15237.41	14706.99

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

Figure 1

One-factor Model

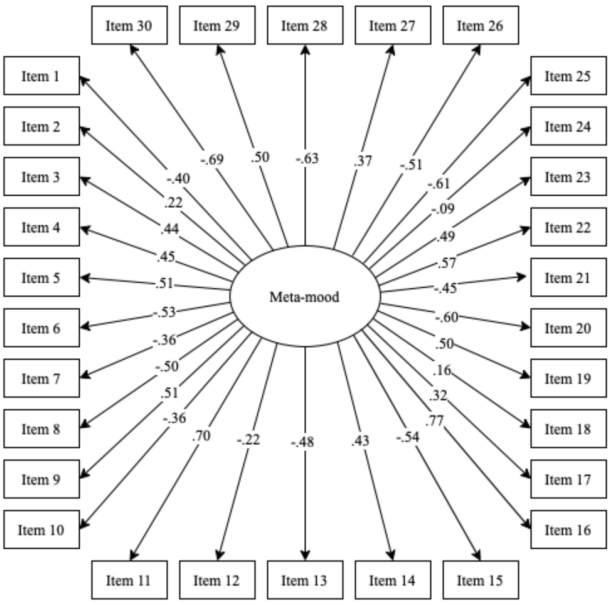

Figure 2

Three-factor Model (Salovey et al., 1995)

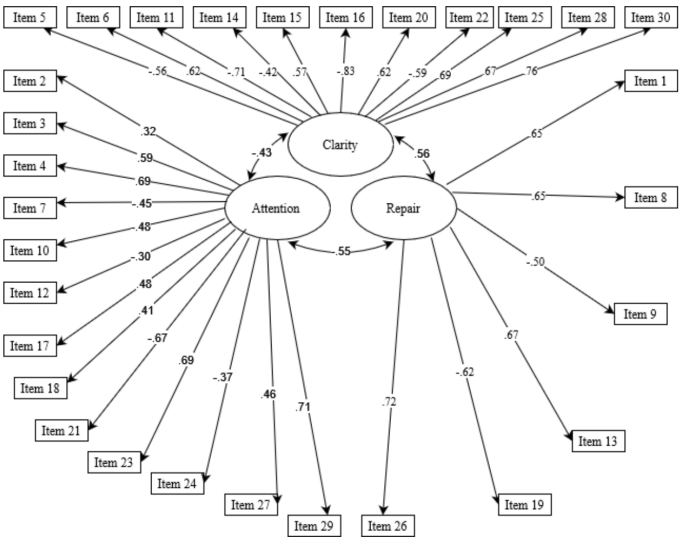

Figure 3

Four-factor Model (Palmer et al., 2003)