USABILITY OF AN ECOLOGICAL MOMENTARY ASSESSMENT APP FOR MOOD EVALUATION IN YOUNG ADULTS – THE MOODWHEEL APP

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Abstract

The purpose of this study was to investigate the usability of a momentary ecological assessment app 'MoodWheel' in the student population.

We explored MoodWheel's usability through standardized measures for assessing app usability. In this study, 505 students (Mage = 19.33, SD = SD =1.80, min. 18 and max.

34) were instructed to use the app daily for an entire month and then complete the System Usability Scale. We then computed the total score including usability, learnability factors.

Our results show a mean of 72.81, SD = 16.52 for the total score, indicating good usability of the MoodWheel app. The Learnability factor obtained a mean of 3.61, SD=.66 which is above average and the Usability factor obtained a mean of 2.91, SD =.66. The usability scale yielded above-average results.

Considering recommendations from literature, we can affirm that the MoodWheel app demonstrates strong usability as an Ecological Momentary Assessment (EMA) app for evaluating mood that has the ability to accurately assess students' levels of stress and overall mental health in the targeted population.

Keywords: Ecological Momentary Assessment; Emotions; Experience Sampling; Usability.

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Challenges related to mental health can affect individuals at any point in their lifetime, but university students of all ages are at particular risk for mental health associated issues due to a variety of novel factors such as moving away from home, financial restraints and social distress that might arise (Bantjes et al., 2023). In this vein, World Mental Health International College Student Initiative is the biggest international enterprise focused on students' mental health with the aim of investigating the fluctuations in mental health during university years and developing well-defined interventions to help them better manage the encountered difficulties (see Benjet et al., 2023; Tomoiaga & David, 2022). Nowadays, technology-based interventions are the most popular ones due to their accessibility and attractiveness and there are already studies testing and documenting their effectiveness (Tomoiaga & David, 2022; Ebert et al., 2019). Ecological Momentary Assessment (EMA) tools are amongst the newest and most accurate methods to monitor mental and emotional problems due to the experience sampling method used and the advantage of continuously assessing mental health parameters that can be used in defining patterns of emotional and/or mental health problems in order to personalize interventions to each student according to their needs (de Vries et al., 2021).

One such EMA instrument is MoodWheel (MW), created by David (David, 2013) and it is available on Google Play and the App store. The tool is based on the Circumplex Model of Emotions (Russell, 1980) and the Binary Model of distress (Ellis & Harper, 1975; Ellis, 1991) and is composed of four subscales: negative functional emotions, negative dysfunctional emotions, positive functional emotions and positive dysfunctional emotions. The app offers users the possibility to rate each emotion on the mood wheel and indicate their intensity, to measure their pulse using the camera from the mobile, to measure physical activity and to monitor social media use on their telephone. Moreover, the app can be personalized to include the ABC model of cognitive-behavioral therapy (Ellis, 1991) and psychological questionnaires. Furthermore, the Google Play version of the app can be connected to a wearable device (Polar Verity Sense) that can measure heart-rate variability. MoodWheel`s preliminary investigation was conducted by David in 2013 using a sample of 82 adults and the results showed adequate reliability and internal consistency. The MW app has two versions, one for adults and one for children and adolescents. Each of the two versions can accommodate appropriate psychological questionnaires while the children`s version has a prompt for each emotion, to help them better distinguish between them.
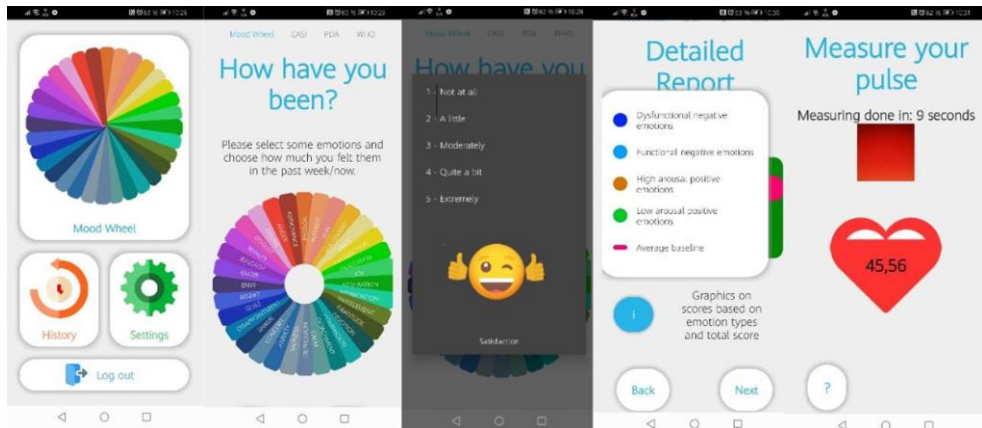
Figure1. The MoodWheel

The app was used in a study to monitor students' emotions and stress during their first year of college (David et al., in preparation). We investigated the app`s factorial structure and validity against standardized measures for children and adolescents (David, Tomoiaga & Fodor, in review) and for the student population (David, Tomoiaga & Fodor, in preparation). Apart from validity and factorial structure aspects, the acceptability of the app and intervention is a very important and heavily debated subject in literature regarding the use of mobile apps for mental health assessment and interventions (Berry et al., 2016).

The usability aspect is mostly studied employing the System Usability Scale (SUS; Brooke, 1986). O'Donnell and collaborators (2019) assessed usability of a mobile intervention for alcohol-harm minimization intervention using the SUS scale and their results showed that the app had good usability above the cutoff of 68. Newton and collaborators (2020) tested a CBT-based app for adolescents with anxiety and assessed its usability with the SUS scale. Their results showed above average scores for the total scores of SUS. Boemo and collab. (2022) also developed an EMA-based app to assess emotions and emotion regulation obtaining above average evaluations for usability.

The aim of the study was to assess the usability of the MoodWheel app in the student population. We collected usability data of the app on students who participated in another research project that used the MoodWheel app for mood assessment.

Method

Participants & Procedure

Participants were 505 students, mean age of 19.33 (*SD* =1.80, min 18 and max 34) that were enrolled in a study that involved using the MoodWheel app to monitor their mood. Out of our sample, 75% were females and 51% of them used the iOS operating system while 49% of them used an Android system.

Participants were instructed to use the MoodWheel app to monitor their mood daily for a month. Following that month, they were asked to complete the usability scale (SUS; Brooke, 1986). The MoodWheel app is an ecological momentary assessment instrument that is available on mobile on Google Play and the App Store. In order to gain access, participants have to create an account using a valid email address or by using Facebook or Gmail accounts. Then, they must agree to the terms and conditions. Furthermore, they are asked to evaluate how they are feeling now on the mood wheel (see *Figure.1*) and are invited to select each emotion and indicate its intensity on a scale from 1 to 5. After completing the evaluation, they receive a graph with their stress levels and are invited to record the rest of the parameters (e.g., heart-rate, physical activity, mobile activity such as call log, social media use and psychological questionnaires).

Measure

For assessing usability in students, we used the System Usability Scale (SUS; Brooke, 1986). SUS is a self-report scale containing 10 items, each of them describes a specific feature of the usability aspect such as frequency of use, complexity or learnability. The scale was widely used in studies for assessing usability (Kaya et al., 2019; O'Donnell et al., 2019) by computing a total score. The total scores ranged from 0 to 100 and studies suggest that a score above 68 (Brooke, 1986) represents good usability. All items are rated on a 5-point Likert scale from strongly disagree to strongly agree. Other studies using this scale compute other two factors such as learnability and usability, but there are concerns and debates regarding their factorial structure, so results should be interpreted with caution (Lewis, 2018). In this study we computed the total score and also the Usability and Learnability factors. Besides the scale, we also included three more items targeting perceived discomfort, perceived disturbance of intimacy and time taken to get through the app. All three items were negatively phrased (e.g., the app and the parameters assessed are making me uncomfortable) and were rated on a 5 point Likert scale from 1 - strongly disagree to 5 - strongly agree.

Results

Our results are based on a sample of 505 students with a mean age of 19.33. We computed the total score of SUS by scoring each item on the scale. The odd numbered items 'score is the item position minus 1, and for the remaining one's it is 5 minus the score position. The total score is calculated by multiplying the sum of the items by 2.5, thus resulting in a total score ranging from 0 to 100. Our result showed a mean of 72.81, *SD*= 16.52 for the total score, indicating good usability. For the Learnability factor we obtained a mean of 3.61, *SD*=.66 which is above average and for Usability factor we obtained a mean of 2.91, *SD* =.66. Both scores are above average, indicating good usability and learnability, but there are no guidelines on how to interpret them. The data pertaining to means and standard deviations is presented in *Table 1*.

Table 1. Means and standard deviation

	N	Minimum	Maximum	Mean	Standard Deviation
SUS Total	505	5	100	72.81	16.525
Usability	505	2	9	2.77	1.324
Learnability	505	8	32	23.34	3.509
Intimacy	505	1	5	1.88	1.123
Discomfort	505	1	5	1.84	1.080
Valid (listwise)	505				

In regard to the discomfort item, the mean score was 1.84, *SD*= 1.08 indicating that participants did not consider that the app made them feel discomfort. The mean for privacy was 1.88, *SD*=1.12, indicating that participants did not consider that the app invaded their privacy.

Discussion

The aim of the present study was to assess the usability of the MoodWheel app in a student sample. We assessed usability of the MoodWheel app on a sample consisting of 505 students who participated in a larger study and had to complete the MoodWheel app daily, completing the usability app a month later.

Results of the usability scale were above average and taking into account the recommendations (De Vries et al., 2021) from literature we can conclude that the MoodWheel has good usability as an EMA app that evaluates mood. The Learnability and Usability scores also represent above average evaluations, indicating the app's acceptable usability.

Our results regarding the privacy and discomfort add on to the acceptance of the App by the targeted users. Acceptance is an important aspect when considering apps used for mental health assessment and/or interventions and is widely discussed in literature (Berry et al., 2016).

Our results on the usability of our EMA app are similar to those reported in literature. Bailon & collab. (2019) evaluated the usability of their EMA app used for assessing affective states and their results on usability were a little lower compared to our results. This indicates that MoodWheel has the opportunity to be more feasible and accepted by the population as an evaluation instrument.

This study has important implications especially regarding practical aspects. Having an EMA tool that has high usability and acceptability to evaluate emotions in student populations is important and very useful due to the access to real time monitoring of emotions allowing for the possibility of developing personalized interventions. Also, MoodWheel represents an accessible and easy to use assessment method that can be further enriched to address all needed aspects and using EMA methodology which is in line with the latest recommendations for early detection of emotional problems.

Limitations

This study has the limitation of relying only on a self-report instrument and not including other types of qualitative assessment as well. However, focus groups were used as part of the refinement process.

Conclusion

In conclusion, in this study, we investigated the MoodWheel app, as a new measure developed in an ecological momentary assessment framework, that has the ability to accurately assess students' levels of stress and overall mental health. Results have shown that the app has good usability and acceptability in the targeted population and a promising ability to detect psychological distress.

Authors' note

Declaration: The first author was involved in collecting data and writing the paper and the second author was involved in writing the paper. The third author performed the conceptualization, supervision, acquiring the funding and revision of the manuscript.

Conflict of interest: None.

Disclosure of interest: The authors declare that there are no conflicts of interest associated with this publication.

Informed consent: Informed consent was obtained from all participants included in the study.

Ethical approval: All procedures performed in study involving human participants were in accordance with the ethical standards of the institutional research committee. The study was approved by the The Scientific Council of the Babeș-Bolyai University with the approval number 14.182/14.10.2022 and preregistered in Clinical Trials with no NCT06085872.

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

The datasets generated during and/or analysed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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