

## Exploring the User Engagement Scale Short Form as a Determinant of Adherence in Digital Health Interventions

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### Abstract

Adherence determines the impact of digital health interventions. Standard tools provide a measure for user experience and predict adherence. We evaluated the User Engagement Scale Short Form (UES-SF) during the POEmaS project, a randomized clinical trial of an online weight loss platform. We received answers from 178 participants (13.7% of the cohort) and correlated the UES-SF scores with the number of sessions attended. Our findings suggest the UES-SF is an accurate evaluation of user experience, but only one domain (reward) was associated with long-term use.

### Keywords:

Patient participation, telemedicine, clinical trial

### Introduction

Lack of user engagement and adherence with digital health tools is a common issue in large-scale online interventions. The User Engagement Scale (UES) is a tool that helps evaluate the main determinants of adherence. Initially developed for e-commerce, social media, and search situations, the UES is based on general psychological constructs and can be used in other domains [1]. The UES has a short form (UES-SF) [2] which is composed of 12 questions divided between 4 domains: perceived usability (PU), aesthetic appeal (AE), focused attention (FA), and reward (RW). The RW domain is a summary of three domains from the original UES: endurance, a measure of how successful the interaction was and the likelihood of recommending the application to others; novelty, a measure of curiosity and interest; and felt involvement, a measure of the feeling of being “drawn in” and having fun [2].

We evaluated the applicability of the UES-SF to the digital health domain. We explored the use of the UES-SF to evaluate how users perceive a digital health intervention for weight loss and to understand which facets of the UES are most predictive of long-term adherence.

### Methods

The Online Platform for Healthy Weight Loss (POEmaS) project has been extensively described elsewhere [3]. It was a randomized controlled trial that investigated the effectiveness of an online platform which delivered a 24-week behavior

change program on weight loss and lifestyle habits. The yearlong trial (September 2017 to October 2018) enrolled 1298 eligible participants ( $\geq 18$  years of age, BMI  $\geq 25$ kg/m<sup>2</sup>, not pregnant or undergoing other treatments for weight loss) who were students or staff of the Universidade Federal de Minas Gerais (UFMG) in Brazil. The project was approved by the UFMG Ethics Committee (CAAE: 73545717.5.0000.5149) and is registered as NCT03435445.

Participants were randomly allocated at a 1:1:1 ratio into three parallel arms: 1) those given access to the web-based platform; 2) those given access to the platform plus online coaching with a registered dietitian; and 3) the waiting list group, which received access to the platform after six months. The behavior change intervention was similar for all groups [4].

Prompts for answering the UES-SF were submitted to all participants by email. Users in groups 1 and 2 (platform access) were prompted at the end of the program (six months). Users assigned to the waiting list were prompted one week after gaining access to the full platform in order to evaluate whether the scale’s predictive capacity changes over time. All questionnaires were answered electronically at a webpage built specifically for the purpose and were not part of the normal usage session.

Answers were analyzed after the end of the trial. We determined Pearson’s correlation coefficients between long-term engagement and the score for each domain separately, as well as the overall score. We also used Student’s t-tests to compare the mean UES-SF score in each domain between users who only used the platform for one day and users who returned at least once; we did the same to compare users who attended more than seven sessions with those who did fewer than seven sessions. Statistical analysis was performed using the SciPy package v1.1.0.

### Results

The questionnaire was offered to all 1298 participants of the POEmaS project. We received 178 (13.7%) responses. Responders were older than non-responders but had similar baseline body mass indices (BMI). The responder group had significantly more female users. The clinical trial arm was not determinant for whether the user answered the UES-SF questionnaire. The comparisons between the responder group and the non-responder group can be seen in Table 1.

Table 1 – Baseline Characteristics of UES-SF Responders and Non-Responders

	Non-responders	Responders	p-value
Female (%)	847 (75.6%)	149 (83.7%)	0.023
Mean age	33.35	35.27	0.020
Mean baseline BMI	29.96	29.46	0.15
Waiting list (%)	349 (31.1%)	59 (33.1%)	0.79
Total	1120	178	

The platform was highly rated by the users in the four domains of the UES-SF. The response averages can be seen in Figure 1. Platform evaluation was not significantly different between participants in different trial arms.

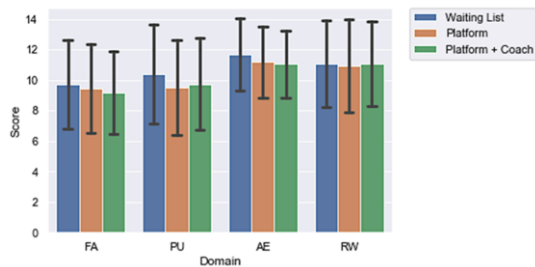


Figure 1 – Average UES-SF scores, stratified by domain and trial arm (mean and standard deviation shown). FA=focused attention, PU=perceived usability, AE=aesthetic appeal, RW=reward

The overall UES-SF score was positively associated with engagement measures. When considering the different domains, only the RW domain retained statistical significance (Table 2).

Table 2 – Association Between UES-SF Scores and the Total Number of Sessions, Stratified by Domain

	Pearson correlation coefficient	p-value
UES (all domains)	0.1864	0.013
Focused attention	0.1202	0.110
Perceived usability	0.0493	0.514
Aesthetic appeal	-0.0111	0.883
Reward	0.3011	<0.001

UES-SF scores stratified by domain between users who used the platform for only one day and users who returned at least once were significantly different for the FA, AE and RW domains (Table 3). When comparing between users who attended more than seven sessions and those who did fewer than seven sessions, only the differences in the RW domain retained statistical significance.

Table 3 – Association Between UES-SF Scores and Short-Term Engagement, Stratified by Domain

	1 session	> 1 session	p-value
Number of users	41	137	
FA (mean)	8.24	9.8	0.002
PU (mean)	9.81	10.17	0.524
AE (mean)	10.61	11.51	0.029
RW (mean)	9.76	11.39	0.001

## Conclusions

The UES-SF was useful as an engagement evaluation for digital health interventions. Among the four dimensions explored in the questionnaire (reward, perceived usability, aesthetic appeal and focused attention), all but perceived usability are associated with short term engagement. However, only the reward dimension is associated with long term engagement.

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