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Mood-Tracking Application as Persuasive Technology for Reduction of Occupational Stress

Abstract

Occupational stress is a major concern in the job performance of employees. The use of persuasive technologies is one way to prevent or reduce this stress. Of the different types of persuasive technology, software applications on mobile phones are the most well-known because mobile phones are available everywhere and can be easily applied for this purpose. The present study as a pilot study developed a mood tracking application and tested its effect on stress reduction of employees. Pretests and posttests were completed by participants to investigate the effects of mood tracking on the reduction of stress in the work environment. Twenty-six employees of a petrochemical company were divided into equally-sized groups of married and single participants. Two types of accommodation are offered in this company based on the marital status of the employees. Other variables effecting stress, such as working conditions, were same for both groups. An OSI-R questionnaire was used to collect data before and after four weeks of application use. In present pilot study, data analysis shows that this kind of persuasive technology can have a significant positive effect on single employees and help them to decrease and manage their stress; however, no meaningful results were recorded for the married group because they did not use the application as much as participants in the single group.

Purpose: The present study as a pilot study developed a mood tracking software application and tested its effect on stress reduction of employees.

Design/methodology/approach: Pretests and posttests were completed by participants to investigate the effects of mood tracking on the reduction of stress in the work environment. Twenty-six employees of a petrochemical company were divided into equally-sized groups of married and single participants. An OSI-R questionnaire was used to collect data before and after four weeks of application use.

Findings: In present pilot study, data analysis shows that this kind of persuasive technology can have a significant positive effect on single employees and help them to decrease and manage their stress; however, no meaningful results were recorded for the married group because they did not use the application as much as participants in the single group..

Originality: To the best our knowledge, no research has been carried out on the effect of mobile stress management software which utilizes mood-tracking. A lack of experimental research on the effect of such application on occupational stress would hinder organizations when making decisions about recommending it to their employees.

Key words: mobile learning, occupational stress, persuasive technology, self-monitoring, mood-tracking, stress management, organizational training.

Introduction

Stress is the body's reaction to a change that requires a physical, mental or emotional arrangement (Benson and Stuart, 1993). Stress has different levels and a certain amount of it is normal and necessary. It is experienced in human life as early as the fetal stage (Middlebrooks and Audage, 2008). This feeling is a natural part of human life and occurs when human beings face significant changes in their lives. It can be either positive or negative. Sometimes stress forces individuals to accomplish goals; this is positive stress. Sometimes it frustrates individual life and causes mental and physical problems; this is negative stress (Yerks and Dodson, 1908).

Occupational stress is a major concern in work environments. Occupational stress is defined as "the negative environmental factors or stressors (e.g., work overload, role conflict/ambiguity, poor working conditions) associated with a particular job" (Cooper and Marshal, 1976). Job stress can have harmful effects on employee health and well-being and on organizational productivity and profits (Bickford, 2005). Work-related stress could be a consequence of the economic situation, a high work load, lack of autonomy, a low level of job satisfaction and job insecurity and sometimes leads an employee to change jobs. Hoel et al. (2002) described such changes as specific to industrialized countries since the 1980s. Cooper and Marshal (1976) studied the link between environmental and individual sources of occupational stress to physical and mental illness. Their intention was to cover research in disciplines such as management, psychology, sociology and medicine and between disciplines.

There are various types of interventions for occupational stress management. Richardson and Rothstein (2008) conducted meta-analysis on the effect of 55 intervention programs. Some of the interventions studied were cognitive-behavioral, relaxation and organizational interventions. Fevre et al. (2006) recommend secondary approaches to stress management as first-line intervention before the adoption of primary intervention. Primary intervention focuses on organizational processes and structures to manage occupational stress, while secondary intervention focuses on the individuals within the organization. It is also important to take into account the conditions which need to be created in order to achieve potentially successful outcomes and improve intervention effectiveness as studied by Coffey et.al (2009).

The OSI-R questionnaire and its occupational stress and strain concepts are based on the person-environment (P-E) fit theory (Caplan, 1983). This model describes stress as being the result of an imbalance between a person and his/her environment (Cooper et al. 2001). The approach of French et al. (1982) distinguished between a person's subjective view of the environment and the objective environment and is very similar to the P-E fit model. Their research focused on a person's subjective view (the P side of the P-E fit model) to manage occupational stress.

With global usage of the internet and computing devices, persuasive technologies can be studied as one category of intervention program to improve physical and mental health, including job-related health. Fogg (2003) defines persuasive technology as "any interactive computing system designed to change people's attitudes or behavior". He mentioned the Body Awareness

Resource Network (BARN) as one of the first systems developed. BARN was designed to improve adolescent behavior in areas such as smoking, drugs and exercise.

Smartphones and mobile apps can be utilized to improve health outcomes especially by mobile learning. Such technologies can make older intervention programs more accessible and provide flexible access to care at lower cost (Marks et al., 2011, Bert et al., 2014). Despite its influence on mental health, mobile mental wellness apps are still in their infancy (Harrison et al., 2011). Software applications on mobile phones have the potential to improve fitness, healthy lifestyles, disease management, and public health (Coughlin et al., 2016, Rodríguez et al., 2014, Direito et al., 2015). As an example, the mobile phone accelerometer can be used to count steps to monitor and promote physical activity; older forms include a pedometer as a small wearable device. Self-monitoring technologies are persuasive technological tools that "allow people to monitor themselves to modify their attitudes or behaviors to achieve a predetermined goal or outcome" (Fogg, 2003). These tools can help users manage their mental conditions and health in addition to their physical health. They can be applied to management of mental illnesses such as depression, bipolar disorder and schizophrenia (Oinas-Kukkonen, 2010). Other tools have been developed for estimation and improvement of adherence to medication use in patients with depression (Robertson et al., 2005) and schizophrenia (Diaz and Levine, 2001).

Some of these tools were designed and developed for stress management. Ahtinen et al. (2013) designed the Oiva mobile application to study the effectiveness of a mobile mental wellness training application on people in the work place. This application utilizes Acceptance and Commitment Therapy (ACT). They tested the application for one month on employees to investigate its acceptance and user experiences with the application. They concluded that the Oiva application was useful and practical for stress management among workers.

It is also important to take into consideration, individual and organizational differences influencing decision of using an app in workplace health promotion (WHP) apps as Dunkl and Jemenez mentioned in their study. The results of their research indicated that younger leaders and leaders with a more positive attitude toward workplace health promotion are more likely to use an app. (Dunkl and Jiménez, 2016)

To the best our knowledge, no research has been carried out on the effect of mobile stress management software which utilizes mood-tracking as an organizational training app for self-management. A lack of experimental research on the effect of such application on occupational stress would hinder organizations when making decisions about recommending it to their employees. The main objective of the present pilot study was to evaluate the effectiveness of mood tracking by a mobile persuasive application on reducing stress in the work environment.

Theory

The Oxford dictionary defines self-tracking as "the practice of systematically recording information about one's diet, health, or activities, typically by means of a smartphone, so as to discover behavioral patterns that may be adjusted to help improve one's physical or mental well-being". Self-tracking can help individuals gain some level of self-knowledge or self-awareness

through the quantitative data they collect. The duration of self-tracking depends on the tracker; some do it for a short time and others use this method for long periods. Techniques to monitor an individual's life and health to increase self-knowledge are not a new concept. Older self-trackers used traditional methods such as journaling and diary-keeping to keep track of themselves. Fox and Duggan (2013) stated that many people would rather use simple ways of monitoring (written records) instead of digital technology, but that the current focus is on both forms of self-tracking. Many devices are used to collect and share data easily, such as mobile phones and digital sensors that can connect to the internet.

Self-tracking and self-monitoring are similar. "Self-monitoring is a method of systematic self-observation, periodic measurement and recording of target behaviors with the goal of increasing self-awareness" (Kanfer, 1970; Wilde and Garvin, 2007). Although these two terms are sometimes used alternatively, to be precise, when self-monitoring is embedded in wearable sensors, computers and new technologies, it is known as self-tracking (Lupton, 2014).

Of the ways to stimulate behavioral change, the development of self-awareness during self-monitoring is of great importance. Methods such as self-observation, recording, and self-evaluation can improve self-management (Wilde and Garvin, 2007). Self-monitoring has been used as a support technique in the treatment of diseases such as diabetes (Davis and Alonso, 2004), asthma (Hendricson et al., 1996), heart disease (Halm and Penque, 2000) and cancer (Larson et al., 1999). This technique helps individuals pay careful and regular attention to their behavior and habits with the goal of changing them (Sacconi et al., 2006). Kanfer (1970) stated that self-observation has as its main object self-directed behavior change and is needed to understand self-regulatory processes, self-control and self-reinforcement. These concepts help people to attain self-performance standards.

Journaling is a known method of self-monitoring and self-care. Research about cognitive-behavioral therapy has shown that people can feel the noticeable effect of journaling on individual self-growth and interpersonal characteristics (Fritson, 2008). Pizarro (2004) indicated that journaling is one of the most effective interventions for reduction of stress and anxiety over interventions such as therapy, courses and training. The different types of journaling include:

- Visual journaling as art therapy used to control trauma resulting from war, terminal illness, natural disaster, and family crises. For example, painting and sculpture were used by survivors of Hiroshima to treat fear, anger, resentment, and isolation (Yamaguchi, 1997).
- Expressive writing about emotional experiences can improve psychological and physical well-being by reducing stress and stressor-related thoughts (Lepoer, 1997).
- A central role for maintaining good health (well-being) in psychological research studies is defined as emotional expression. Most psychologists believe that emotional expression is vital for mental and physical health. Pennebaker developed the emotional expression

method and asked his participants to express their deepest thoughts, feelings, moods about trauma. He presented the best effects as a way to reduce stress (Smyth, 1998).

Many studies point to the theory of Pennebaker about emotional expression and its effects on reduction of stress. This theory states that people who express their feelings and stress-related thoughts, either verbally or in writing, can reduce their stress and intrusive thoughts. Journaling methods have changed over time. Tablets, mobile applications and computers are now used to write or record feelings and emotions instead of paper and pen. The present study developed a mobile application to help individuals express their emotions to decrease occupational stress in accordance with the theories explained above.

Method

The research question can be stated as follows: Is there a difference in the level of occupational stress in employees before and after using the application? The null hypothesis (H_0) is: There is no difference between pretest and posttest results. The alternative hypothesis (H_1) is: There is a difference between pretest and posttest results. In order to answer this research question, a software application was developed and a quasi-experimental research program was designed to test two groups and compare pretest and posttest results.

Mobile software application

A mobile application was designed and implemented in Persian specifically for this research (Figure 1). Although there are mood-tracking applications like Moodlytics[1] available on the market for mobile smartphones, none of them was considered suitable for the current study. The main rationales to developing a new application were application language and access to user data. No mood-tracking application was available in the participants' first language, Persian. All interactions of each single participant in the application had to be recorded for the analysis phase, but apps available on the market do not provide access to user data. A new application was used that has been designed and developed by Android Studio as a stand-alone app for Android mobile phones and tablets. Because the new application is in the research stage it is not yet available on the market. This app can be considered to be a tool for mood tracking, journaling or mood-diaries with easy-to-understand data visualization. In addition, users can export their mood history report and application use in the form of an excel file. (Figure 2).

The self-reporting application developed for this study is called "How are you?" and has three features. First, it can be used to record the current mood of the user and his mood in the past. The user can also register the reason for a particular mood and even name the person related to that mood if applicable. He can select his mood from moods defined in the application, such as

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[1] https://play.google.com/store/apps/details?id=AnantApps.Moodlytics&hl=en

happy, sad, bored, tired, frustrated, afraid, confident, scared and depressed. The second feature of the application is the mood charts available to the user. The pie and bar charts of moods from the first day of use can be composed for the user to allow them to view their mood changes and percentage time per day devoted to those moods daily or over longer periods of time. Another feature of the application is relaxation exercise. If users feel that they are under mental pressure, they can listen to and perform the relaxation exercises to decrease their level of stress.

Richardson and Rothstein (2008) in their meta-analysis discussing the effect of 55 intervention programs, state that journaling intervention "is used as a means of assisting the employee to monitor stress levels, to identify the recurring causes of stress and to note his or her reactions. Journals are also used to formulate action plans for managing stress." Offering relaxation exercises in a journaling-app will give the choice to the user of an action plan for managing his/her stress. Benson (1998) developed a simple relaxation response technique that once learned, takes 10 to 20 minutes a day and can help relieve stress and tension. Relaxation therapy focuses on the conscious and controlled release of muscle tension (Richardson and Rothstein, 2008)

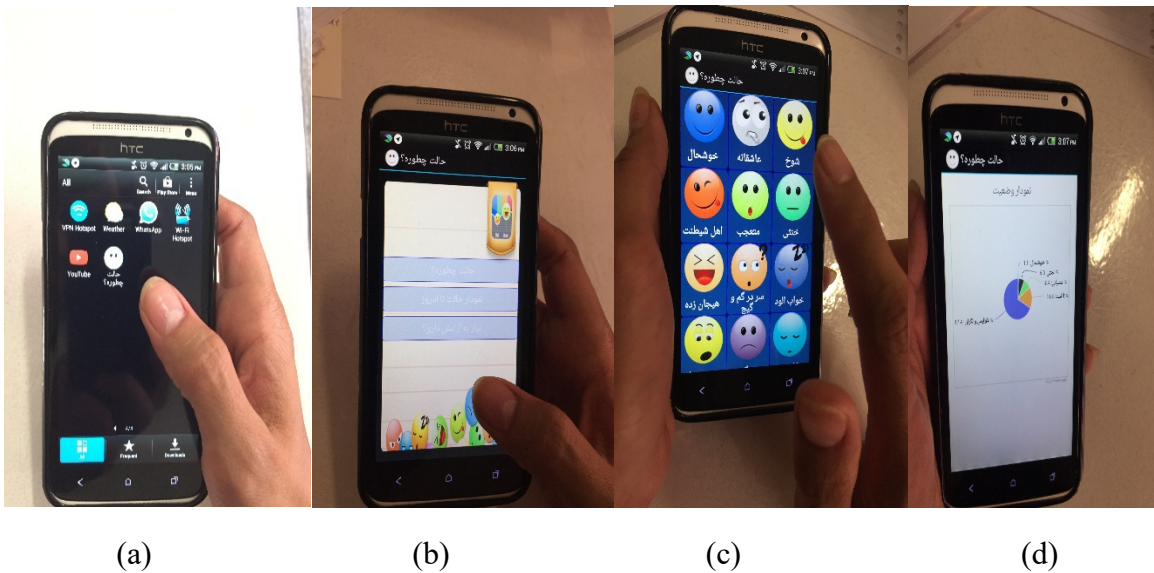|			
(a)	(b)	(c)	(d)

Figure 1. (a) Short-cut to application installed on a mobile phone. (b) Feature of the application that tracks the current mood of the user and his mood in the past (c) Selecting a mood from defined moods (d) Simple pie chart of user moods

Id	Because Of	ForWhom	Mood name	Time	Duration
1	job, friends	null	Tired	Wed Feb 25 21:04:20 GMT+03:30 2015	240
2		null	Elated	Fri Feb 27 10:17:22 GMT+03:30 2015	45
3	job, family	null	Sleepy	Sat Feb 28 18:24:50 GMT+03:30 2015	240
4		null	Sleepy	Tue Mar 03 15:27:09 GMT+03:30 2015	120
5	friends, personal	null	Content	Wed Mar 04 20:42:33 GMT+03:30 2015	15
6		null	Sick	Thu Mar 05 09:35:34 GMT+03:30 2015	960
7	family, job	null	Calm	Fri Mar 06 17:48:19 GMT+03:30 2015	240
8		null	Neutral	Sat Mar 07 07:21:39 GMT+03:30 2015	240
9	family, personal	null	Sleepy	Mon Mar 09 02:39:20 GMT+03:30 2015	60
10		null	Hungry	Tue Mar 10 15:54:53 GMT+03:30 2015	45
11	personal, family	null	Numb	Tue Mar 10 15:56:02 GMT+03:30 2015	60
12		null	Confident	Tue Mar 10 15:56:59 GMT+03:30 2015	240
13	family, personal	null	Naughty	Tue Mar 10 23:55:48 GMT+03:30 2015	15
14		null	Sleepy	Wed Mar 11 02:16:29 GMT+03:30 2015	30
15	friends, friends	null	Crying	Wed Mar 11 02:19:26 GMT+03:30 2015	15
16		null	Cool	Thu Mar 12 02:17:02 GMT+03:30 2015	480
17	personal, friends	null	Neutral	Thu Mar 19 19:00:35 GMT+03:30 2015	60
18		null	Excited	Thu Mar 19 19:00:53 GMT+03:30 2015	15
19	job, personal	null	Confident	Thu Mar 19 19:01:39 GMT+03:30 2015	960
20		null	Anxious	Thu Mar 19 19:02:22 GMT+03:30 2015	60
21	job, family	null	Numb	Thu Mar 19 19:02:49 GMT+03:30 2015	480
22		null	Anxious	Thu Mar 19 19:03:13 GMT+03:30 2015	45
23	people, family	null	Bored	Thu Mar 19 19:04:17 GMT+03:30 2015	120
24		null	Elated	Thu Mar 19 19:05:16 GMT+03:30 2015	60
25	job, job	null	Sleepy	Thu Mar 19 19:05:30 GMT+03:30 2015	60
26		null	Angry	Thu Mar 19 19:05:59 GMT+03:30 2015	120
27	job, friends	null	Bored	Tue Mar 24 07:33:18 GMT+03:30 2015	120
28		null	Surprised	Tue Mar 24 07:34:59 GMT+03:30 2015	120
29	job, job	null	Stressed	Thu Mar 26 07:27:40 GMT+03:30 2015	960
30		null	Sleepy	Sat Mar 28 05:06:14 GMT+03:30 2015	240
31	job, personal	null	Neutral	Fri Apr 10 11:15:23 GMT+03:30 2015	120
32		null	Numb	Sat Apr 11 15:00:03 GMT+03:30 2015	480
33	friends, friends	null	Happy	Sat Apr 11 15:00:52 GMT+03:30 2015	120
34		null	Funny	Sat Apr 11 15:01:26 GMT+03:30 2015	120
35	family, friends	null	Excited	Sat Apr 11 15:01:49 GMT+03:30 2015	30
36		null	Happy	Sat Apr 11 15:04:21 GMT+03:30 2015	120
37	personal, job	null	Cool	Sun Apr 12 15:03:57 GMT+03:30 2015	480
38		null	Sleepy	Fri Apr 17 22:39:05 GMT+03:30 2015	15

Figure 2. Sample of exported excel report.

Participants

Twenty-six employees working at a petrochemical company in southern part of the country were selected and invited to participate in this pilot study. This petrochemical company is a producer and supplier of urea and ammonia but shall remain anonymous. Although one of the biggest gas repositories is located there, it is a deprived area. Occupational stress seems to be relatively high and people face hard working and living conditions. All employees in the region are non-native and come from different parts of the country to work. Their families do not live in the region except for married employees who have their immediate families living with them. The company provides two types of accommodations for their employees based on their marital status. These are located in separate campuses. There is high air pollution, few recreational areas, poor medical and educational facilities, and a high risk of working around toxic gas, therefore people who live and work there seems to experience high levels of stress.

Because stress management interventions in occupational settings differ, the intervention can be classified into levels according to the sources of stress in the workplace (Murphy & Sauter, 2003). The participants were, thus, selected according to their work and living conditions. Because all participants were selected from same working environment with same job specification, intervening variables such as work environment problems, occupational sensitivity, the level of danger such as fire danger and pollution were the same for all. Big differences did exist in living conditions for the single and married participants. Married employees usually live with their families in a furnished house with suitable facilities located in a small town. This group of employees spends most of their free time with their families. Single employees are far from their families and live in small houses sharing rooms with their colleagues. They usually have more free

time, therefore, parameters such as interpersonal strain, self-care and social support differed for the single and married participants. For these reasons, the participants were divided into two groups of married and single participants with 13 members in each group.

All participants were men because women are not allowed to work there. Their educational degrees varied from Associate Degree (11.55%) to Bachelor of Science (73.08%) to Master of Science (15.38%) (Figure 3). High educational status is very common among the employees of this company.
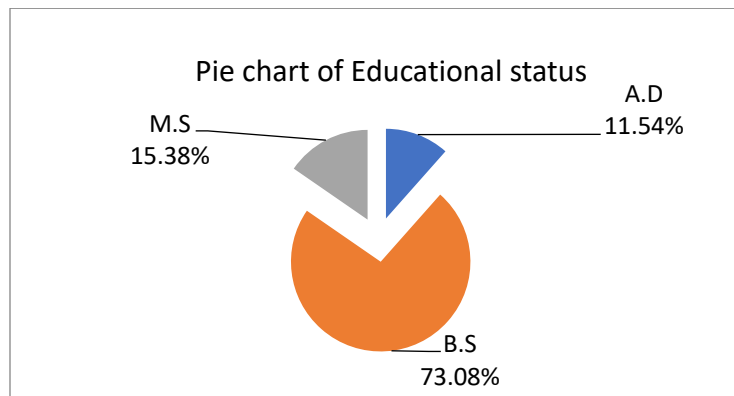

Figure 3. Frequency distribution of study sample based on educational status.

Most participants had less than ten years of work experience (92.30%). Only 7.69% had more than 10 years of work experience (Figure 4). The majority of participants held BS degrees and had less than 10 years of work experience. It should be mentioned that level of education had no effect on the salaries of the study population and every 5 years of work experience increased employee salaries by only 2%-3%.
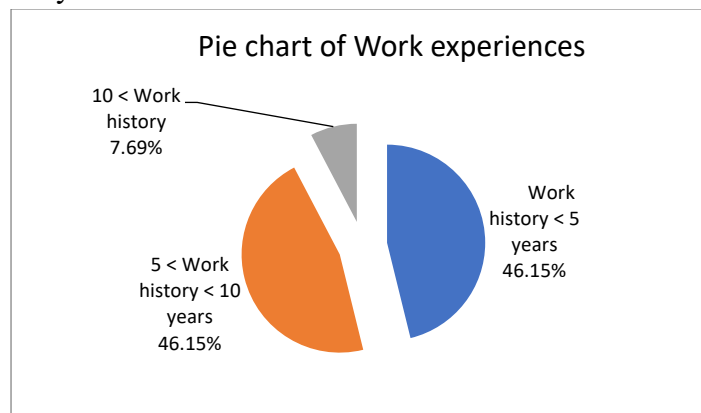

Figure 4. Frequency distribution of the study sample based on work experiences

Questionnaire

The OSI-R questionnaire was used to measure stress level. OSI-R is a valid questionnaire with three sections: the occupational role questionnaire (ORQ), the personal strain questionnaire (PSQ), and the personal resources questionnaire (PRQ). These parts provide a summary measure of three

prominent dimensions of occupational adjustment: occupational stress, psychological strain, and coping resources. In these questionnaires, the particular attributes of the environment and individual are measured. Different scales show different dimensions of occupational adjustment. The present study required only two parts of the questionnaire, the PSQ and the PRQ. Each referred to the indices of vocational strain, psychological strain, interpersonal strain, physical strain, recreation, self-care, social support and rational/cognitive coping. The ORQ was not included in this research because no changes were expected in participant occupational roles during the one-month period of study.

Pretest and posttest results

This study was designed using quasi-experimental pretest and posttest results between groups. Pretest, the participants were asked to complete the OSI-R questionnaire and then the mobile application was installed on the participants' mobile phones. After one month of using the application, the participants were asked to complete the questionnaire again. This time, open-ended questions were included as a qualitative form of expression. Data files were also collected from participants' mobile phones and included their application usage and recorded moods. The data was collected and analyzed to gain an understanding of the effectiveness of this persuasive technology on employees.

All participants had the choice to drop out of the research whenever they felt the need. Three participants decided not to deliver excel files stored on their mobile phones to show their application use to the research team; hence number of participants decreased from 29 to 26.

Statistics

Analysis was carried out using the paired-sample t-test. A paired t-test is applied when the observations in one sample can be paired with the observations in another sample. One example is when the pretest and posttest results are compared, as in the current study. For a paired sample t-test to be valid, the differences should be approximately normally distributed. The normal distribution was checked using the Shapiro-Wilk test on all scales included in the study as a precondition of the paired sample t-test.

The reliability of the measures of the construct was first tested by examining the individual Cronbach's alpha coefficients, which were all greater than the recommended level of 0.7 (0.899 to 0.9014). The construct validity of the OSI-R questionnaire was investigated by a panel of experts comprising university professors and human resource assistants from the organization under study. Data analysis was carried out using STATA11, an integrated statistical software package that provides data analysis, data management, and graphics.

Results

Data analysis of the single group showed a significant decrease in the means of the PSQ for *vocational* and *interpersonal strain* measuring depression, anxiety, sadness and dependence on family members at confidence intervals (CIs) of 90% and 95%, respectively (Tables 1 and 2).

Table 1. Comparison of pre and post-intervention scores on vocational strain scale in single group (n = 13, Pr (T< t = 0.8917), t = 1.3045 , DOF = 12).

variable	Obs	Mean	Std. Err	Std.dev	95% Conf.	Interval
VS_O_VS	13	2.495	0.178	0.642	2.107	2.883
	13	2.205	0.132	0.477	1.916	2.493
diff	13	0.290	0.222	0.803	-0.194	0.775

Table 2. Comparison of pre and post-intervention scores on **Interpersonal Strain scale** in single group (n = 13, Pr (T< t = 0.9654),t = 1.9961 , degree of freedom = 12).

variable	Obs	Mean	Std.Err	Std.dev	95% Conf.	Interval
IS_O_IS	13	2.276	0.171	0.619	1.902	2.651
	13	2.784	0.145	0.525	1.466	2.102
diff	13	0.492	0.246	0.889	-0.045	1.029

No meaningful changes in these indices were recorded for the married group. The mean differences for *vocational* and *interpersonal strain* for both groups are shown in Figures 5 and 6.
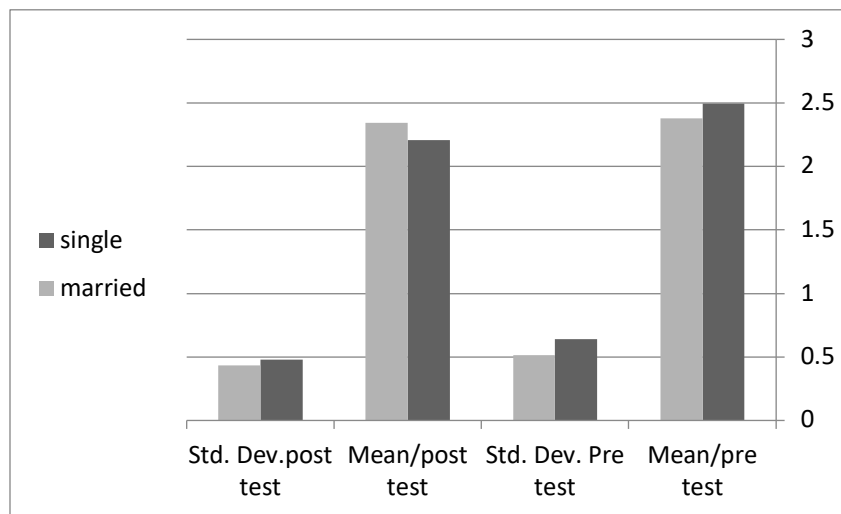

Figure 5. Mean and standard deviation for vocational stress scale for married and single groups
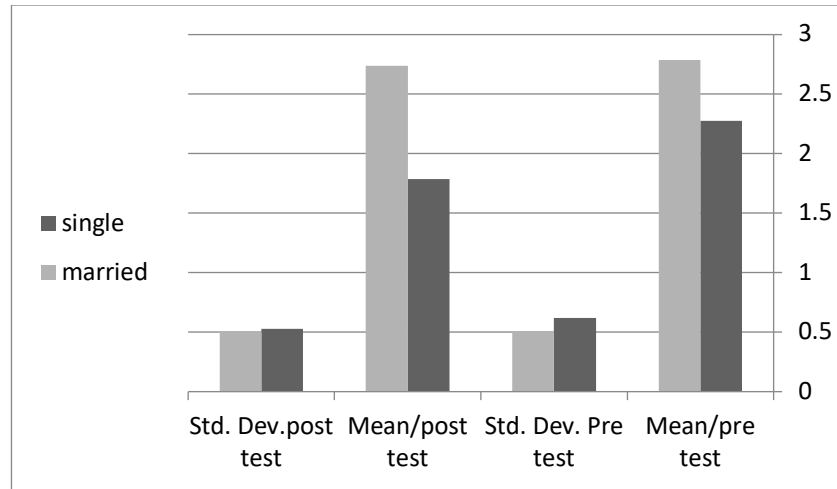
Figure 6. Bar chart of mean and standard deviation for **Interpersonal Stress scale** among married and single groups.

The *recreation* and *social support* indices of the PSQ measure the use of recreation time and participation in activities that the individuals found relaxing and satisfying. These indices increased significantly in the single group at CIs of 95% and 90%, respectively. No change was observed in the married group (Tables 3 and 4).

Table 3. Comparison of pre and post-intervention scores on **Recreation scale** in single group (n = 13, Pr(T> t = 0.9583),t = -1.8886 , degree of freedom = 12).

variable	Obs	Mean	Std.Err	Std.dev	95% Conf.	Interval
RE_O_RE	13	2.430	0.151	0.546	2.100	2.761
	13	2.838	0.131	0.473	2.552	3.124
diff	13	-0.407	0.215	0.778	-0.878	0.062

Table 4. Comparison of pre and post-intervention scores on **Social Support scale** in single group (n = 13, Pr(T> t = 0.8991),t = -1.3501 , degree of freedom = 12).

variable	Obs	Mean	Std.Err	Std.dev	95% Conf.	Interval
SS_O_SS	13	3.059	0.122	0.441	2.793	3.326
	13	3.367	0.230	0.830	2.865	3.869
diff	13	-0.307	0.227	0.821	-0.804	0.188

The mean differences in the *recreation* and *social support* scales between groups are shown in Figure 7 and 8.
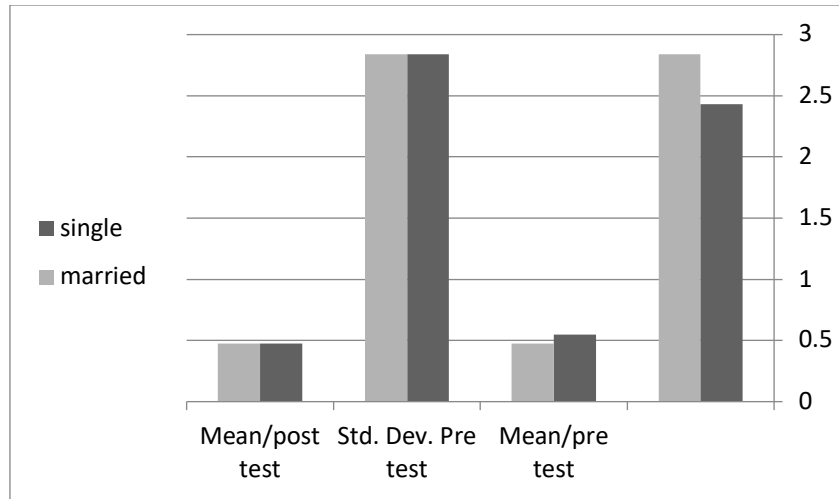
Figure 7. Bar chart of mean and standard deviation for **Recreation scale** among married and single groups.
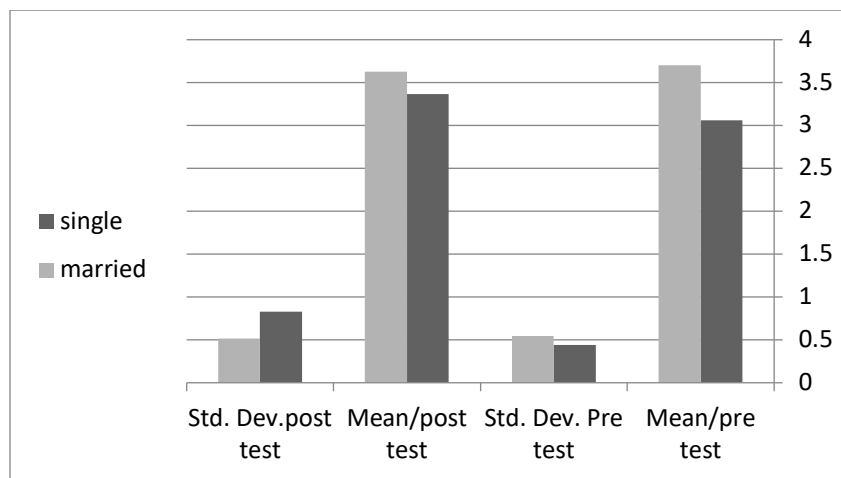

Figure 8. Bar chart of mean and standard deviation for **Social Support scale** among married and single groups.

It is clear that there are statistically significant differences between the pretest and posttest results for the PSQ and PRQ for the single group only at a CI of 90% as summarized in Table 5.

Table5. Changes in PRQ and PSQ scales.

Name of scale	Total sample	Mean	Std.dev.	df	changes
Vocational Stain(VS)	13	2.495	0.642	12	Decreased/Changes in the range of 90% is accepted
	13	2.205	0.477		
Psychological strain(PSY)	13	2.748	0.603	12	No meaningful change
	13	2.558	0.511		

12

Interpersonal strain(IS)	13	2.276	0.619	12	Decreased/Changes in the range of 95% is accepted
	13	1.784	0.525		
Physical strain(PHS)	13	2.738	0.676	12	No meaningful change
	13	2.484	0.658		
Recreation(RE)	13	2.430	0.564	12	Increased/Changes in the range of 95% is accepted
	13	2.838	0.473		
Self – care(SC)	13	2.476	0.493	12	No meaningful change
	13	2.615	0.525		
Social support(SS)	13	3.059	0.441	12	Increased/ Changes in the range of 90% is accepted
	13	3.367	0.830		
Rational/cognitive coping(RC)	13	3.034	0.630	12	Increased/ Changes in the range of 87% is accepted
	13	3.367	0.548		

Several simple linear regressions were performed on one months of data to determine if there were a significant relationship between usage of the application and occupational stress sales. The t-statistics for the slope were significant at the 0.05 critical alpha level, t (24) = -2.136, p=0.043 and t (24) = -1.77, p= 0.044. Thus, the null hypothesis is rejected and can be concluded that there were a negative significant relationships between usage of app and interpersonal strain and psychological strain, respectively. In addition, there was negative significant relationships between usage of app and physical strain with, t (24) = -0.902, p= 0.1 at the 0.1 critical alpha level.

For other scales such as recreation and social support, the t-statistic for the slope were significant at the 0.05 critical alpha level, t (24) = 1.95, p=0.031 and t (24) = 17.42, p= 0, respectively.   For rational/cognitive coping, the t-statistic for the slope was significant at the 0.1 critical alpha level, t (24) =1.25, p=0.09. Therefore, it can be concluded that there were a positive significant relationships between usage of app and recreation, social support and rational/cognitive coping.

Table6.Relationship between usage of the application and Occupational Stress scales

Dependent variable	Model	Unstandardized Coefficients		Standardized Coefficients	Correlation
		B	Std. Error	Beta	Sig.
IS	(Constant)	1.003	0.38		0.02
	USAGE	-0.041	0.019	-0.4	0.02
PSY	(Constant)	1.008	0.538		0.04
	USAGE	-0.048	0.027	-0.342	0.04
PHS	(Constant)	0.304	0.304		0.1
	USAGE	-0.017	0.018	-0.181	0.1
RE	(Constant)	-0.740	0.391		0.03
	USAGE	0.038	0.020	0.370	0.03
RC	(Constant)	-0.564	0.416		0.09
	USAGE	0.038	0.021	0.25	0.09
SS	(Constant)	-1.507	0.088		0
	USAGE	0.77	0.004	0.96	0

* Significant at 5 and 10 percent level; Source: Computed from primary data

Discussion

The self-reporting application was used actively by each participant in the single group on average 23.8 times per month. Although daily mood tracking by application was recommended, some, especially from the married group, did not heed the recommendations. A longer period of study could be more effective for adoption of this tool by users. Statistically, a meaningful decrease in stress level was observed in the single group. In addition to quantitative results, open-ended

questions were asked of participants. The answers to these formed the qualitative results of this study.

Discussion on quantitative results

Significant differences in the mean score in some scales are indicators of improvement in employee mental health. The results showed that the VS, IS, RE, SS and RC scales improved for the single group. Single participants paid more attention to the application and used it repeatedly.

Vocational stress (VS)

A high score of this scale shows that lack of interest, lack of concentration, recurrent absence from work, errors and accident as features of the job. Improvements in this scale through mood tracking and relaxation exercises show that the relaxation technique and/or awareness of moods can reduce vocational stress. Relaxation exercises helped the participants change their mood and relax. It also improved concentration. Mood tracking made participants more aware of their moods and the reasons for those moods. This awareness could help them to manage their vocational stress better.

Interpersonal strain (IS)

This scale has two sides. A high score on this scale indicates either disagreements at work, high dependence on family members and friends or the intention to be alone or willingness to withdraw. The results showed that single users were able to manage their interpersonal stress by mood tracking and relaxation exercises. There is a section in the mood tracking part of the application into which users can register the name of the person causing the current mood and the mood itself. This helped participants identify people who either improved or aggravated their moods. As a consequence, they could manage their interpersonal stress more effectively. The decrease in this scale could also be the result of the relaxation program.

Recreation (RE)

A high score on this scale indicates that users do not take advantage of leisure time to enjoy themselves. The results indicated that users could perceive the benefits of mood tracking and relaxation exercises at work and use it in their lives. This application helped users experience the benefits of spending time on themselves and increase time spent on recreational activities.

Social support (SS)

High scores indicate that the user has found sympathetic people with which to discuss work issues. The results show that this scale increased in the single group when users entered their mood and the reason for it, and the name of the sympathetic person into the application. When the users reviewed the application results, they could find people who supported them and improved their mood.

Rational/cognitive coping (RC)

A high score indicated that the user found a systematic approach for reasoning and problem solving. This scale improved for single users, indicating that they improved their decision making approach by mood tracking. Mood awareness helped them to see important elements causing the mood swings. Improvement indicates that they are able to see important elements of problems and reexamine and reorganize their work. Relaxation exercises could also help the user relax, which improved his ability to resolve the issue at hand.

Psychological strain (PSY), physical strain (PHS) and self-care (SC) did not improve using the application during the test period. The lack of change in some scales could have been the result of the relatively short implementation and testing period. As an example, PSY, which is defined as feeling depressed, anxious or unhappy, generally requires a longer period of time to improve. PHS was not expected to improve because no improvement in physical health conditions occurred during the one month period of study. In fact, these participants regularly suffer exposure to toxic gas and other physical health risks. High scores in SC indicate adequate amount of sleep, regular exercise and careful diet. Employees of the company have regular day and night shifts, so no meaningful improvement in this parameter was expected.

Discussion on qualitative results

Three open-ended questions were asked posttest:
- How has this application influenced your stress management?
- How easy was it for you to use or make connections with this application?
- What are your recommendations for improving this software?

Some users believed that the use of mood tracking and relaxation exercises several times a day in one month period of time had strong effect on their stress management. Some said that its effects were more tangible when they were alone and could concentrate adequately. Some users felt that this application had no meaningful effect on their stress management because the period of time was too short, they were unfamiliar with use of the application or said that they forgot to use the application when they experienced stress.

Most users believed that using this application was easy and interesting, but a number of them said that the alternatives of moods were too similar and they were unable to choose the best one to express their current mood. Finding a convenient place and time to use the application was mentioned as a challenge in the open-ended questions. The users found some parts of the application more challenging, especially the program for relaxation, because there was no suitable place at work to focus and do the relaxation exercises.

The recommendations by users for improving the application were to increase the variety of relaxation exercises and to promote the use of this type of application among employees. Another recommendation was to increase the test period.

Participants (especially the married group) were unfamiliar with these kinds of persuasive technologies. In general, few people know about these persuasive technologies and their benefits for mental and physical health; thus, one month was not enough time to determine the effect of

mood tracking on stress reduction. These comments indicate that users first need a short time to make a connection with the software and feel the benefits of it to be able to use it effectively. Some participants even suggested that organizations promote use of this kind of software.

Conclusion

This pilot study investigated the usage of a mobile software application that tracks moods and offers relaxation exercises to reduce occupational stress. A new mobile application was tested in one month of field research on 26 participants divided equally into married and single users. The results showed positive effects on mental health of the single group on the PSQ and PRQ scales of VS, IS, RE, SS and RC, but a lack of interest in the software among the married group meant there was no meaningful change in stress level for this group. This may be because married users live with their families and are too busy to use the application, which meant they did not use it as much as single participants. The results show that the average usage of the application by each participant in the married group was 12.3 times per month but participant in the single group used the application on average 23.8 times per month.

Such applications are suitable for every day work life. Although the results show that some users did not use the application and disregarded the mood tracking goals, the application can be used to teach skills and methods that have the potential to enhance wellness. Embedding these kinds of technologies into everyday life is one method of mental self-development by mobile learning. An important benefit for users was the real-time mood tracking and availability of relaxation exercises to reduce pressure immediately. Breathing and relaxation exercises can act as a break for employees in the work place. The software application was satisfactory for the relatively short research period. It was quick to learn, easy to integrate into every day work life and needed no guidance or complicated preparation and seems to be a good choice for organizational training.

Unfamiliarity of the participants with the technology affected usage of the application. Some participants forgot to use this tool at critical times. One way to overcome this challenge was to add context-awareness to remind users of the most suitable time to apply the application. A context-aware system can identify and recommend suitable times and a quiet place in which to refer to the program when more concentration is required. Organizations can promote the use of such applications for stress management to help employees use it in the work place on time without fear of censure to manage their stress.

The results of this research suggest that the mood tracking and relaxation mobile application is a suitable starting point for continued research on mobile support and learning as a persuasive technology to improve mental health. Future research on a mood-tracking application as a mobile mental health application could study the comparison between the effect of mobile mood-tracking applications and web-based mood-tracking on decreasing occupational stress. Factors that influence married employees, who did not use the application as much, could be studied as a future direction. These factors could include parameters such as their living conditions, free time and

emotional support from families. The effects of parameters such as education level, type of job, and work environment on decreasing occupational stress among employees are other subjects of future research.

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