Developing android-based application for relieving fatigue

by Syamsul Gultom

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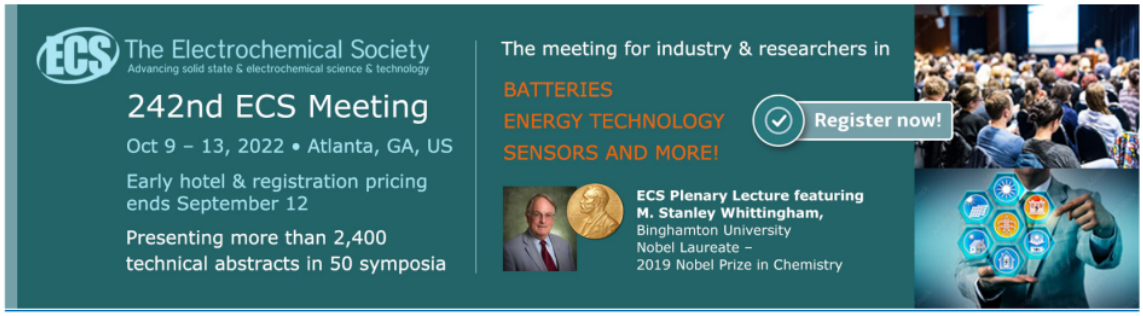

Developing android-based application for relieving fatigue

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Abstract. Fatigue is the problem for all workers in the world. Fatigue can influence the work performance of the workers. A relaxation model to decrease the fatigue level had been developed before by the researcher, it is named TOM'S MODEL. By, the increasing of the technology, so this study tried to improve TOM'S MODEL into android-based application. The participants of the study were the workers in one university in Indonesia. There were fourty workers recruited for this study. The participants were involved in a series of treatment. Altogether there are five treatments included pre-test and post-test. The physical fatigue and mental fatigue measured by using Whole Body Reation Tester (WBRT) and Bourdon Wiersman. The results show that there is significant reducing of fatigue both physical and mental, after the participants applied the relaxation from the android application. The interview results show that the android-based application is easier to use since it is integrated in their cellular phone. They can use it at any time and place during their work without any problems. The movement in relaxation is also simple to follow. This application can be applied for all workers in any field.

Introduction

Definitions of fatigue vary in the research literature and are typically dependent on the discipline of the researcher team members (Jorgensen, 2008; Ream & Richardson, 1996). Ream and Richardson (1996) proposed a definition of fatigue commonly used by health science researchers:

Fatigue is a subjective, unpleasant symptom which incorporates total body feelings ranging from tiredness to exhaustion creating an unrelenting overall condition which interferes with individuals' ability to function to their normal capacity. (p. 527)

The use of the term fatigue in day-to-day language is not as inclusive as any of the definitions above. Most definitions in dictionaries refer to fatigue as a stage following exertion, associated with mental or physical weakness and a temporary decrease in functional ability (Ream & Richardson, 1996). In the study discussed in this article, no particular definition of fatigue was adopted. Rather, a description of fatigue was developed based on the experiences of study participants.

Fatigue can influence employee performance, particularly for employees working consecutive long-hour shifts within 1 week (Australian Council of Trade Unions [ACTU], 2000). Fatigue, defined as "an overwhelming sense of tiredness, lack of energy, and a feeling of exhaustion associated with impaired physical and/or cognitive functioning" (Shen, Barbara, & Shapiro, 2006, p. 70), has been associated with changes in mood, cognitive problems, reduced motivation and job performance, physiological changes, and safety risks (Rogers, 2008).

So, relieving fatigue is very crucial for the workers. This current study developed an android-based application for relieving fatigue from the workers. The previous study from the researcher had invented a model for fatigue relaxation called TOM'S MODEL. In this current study, the researchers developed the model into an android-based application. There were 40 participants involved in this study. They

experienced five stages of treatments. During the treatment, they apply the android-based application to reduce their fatigue while working. This application was helpful to the workers in relieving their fatigue.

1.1. Fatigue in office

Fatigue is a multifaceted concept involving psychosocial and behavioral processes difficult to define and distinguish from sleepiness (Cavuoto & Megahed, 2017). Fatigue is defined as an "overwhelming sense of tiredness, lack of energy and a feeling of exhaustion, associated with impaired physical and/or cognitive functioning" (Shen et al., 2006, p. 70). Shen et al. (2006) noted that fatigue is often conceptualized as dualities, such as acute versus chronic or psychological versus physiological, but suggested that these dualities do not adequately reflect the multidimensionality of fatigue. Fatigue can be caused by extended work hours, disturbances of a person's circadian rhythm (Gaba & Howard, 2002), extreme variation in sleep and work hours, and disruptions of the nighttime sleep cycle. Many studies use the terms sleep and fatigue interchangeably, or measure sleep and then draw conclusions about fatigue (Gaba & Howard, 2002; Rogers, 2008; Shen et al, 2006).

Workplace fatigue may result in numerous negative outcomes, including reductions in workplace productivity (Atkinson, 2000; Cavuoto & Megahed, 2017), increased rates of poor employee decision-making, and accidents and injuries (Atkinson, 2000). These negative outcomes may translate to camp settings; as stated earlier, camp adverse events increase later in the week and fatigue may be a contributing factor. Fatigue may also decrease motivation, concentration, and an employee's ability to perform tasks correctly (Sadeghniiat-Haghighi & Yazdi, 2015). To compound challenges associated with fatigue-related errors, staff who become fatigued are less able to gauge the effects of fatigue. Therefore, staff who are fatigued do not appreciate how their work performance may be negatively impacted by fatigue.

These outcomes may be particularly detrimental in the context of camp where staff are not only responsible for ensuring their own safety but also the safety of minors under their supervision. Within the camp setting, staff supervise youth in novel environments (i.e., nature, unfamiliar terrain, and overnight) as well as during high-risk activities where accidents and injuries are more likely to occur (Goldlust et al., 2009).

The literature suggests strategies for addressing workplace fatigue. In a clinical review by Dawson, Chapman, and Thomas (2012), the researchers examined fatigue interventions in work settings with longer than normal shifts or work hours. Informal "fatigueproofing" strategies included repeating instructions, using verbal and visual confirmation, and self-reporting of fatigue. In addition, Sadeghniiat-Haghighi and Yazdi (2015) suggested workplace fatigue could be managed by promoting both the quality and quantity of sleep. However, Rogers (2008) noted that promotion of sleep quality requires a change in workplace culture, where coming to work well rested is valued, and over-exhaustion is viewed as a risk rather than a sign of dedication.

1.2. Android-based application for fatigue relief

This android-based application had been improved from the first version. This current version is more complete than the previous one. This application is written in Bahasa Indonesia. This application has four features. The first feature is home which consists of material, profile, and references. The second feature is video. In this feature, there are four videos given. The first video is the relaxation movement for fatigue relief. The second and third videos are about the measurement of physical and mental fatigue. And the last video is the explanation from the researcher. The third feature is the information table for how many calories we need for one day which is classified into age, gender and activity. The last feature is the place for making notes whenever we make any note.

Fig.1. The icon for the application

The icon for this application is named Tom's Model. The name was given by the researcher when he invented this relaxation treatment for the first time. The relaxation treatment had been proved for relieving fatigue among the workers. The relaxation treatment is the movement for stretching our muscle and joint after working. The movements are easy to follow. This movement is combined with the instrument which was composed from the traditional music. This traditional music instrument helps the workers to get more relaxed so they can relieve their fatigue.

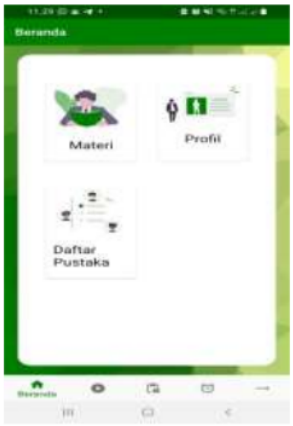

Fig. 2. Home feature

Home feature from this application consists of three parts, material, profile, and references. In material feature, the participants can get information about fatigue, the definition of fatigue, the cause, the effect, and how to relieve it. The profile feature consists of the information of the researchers. The participants can see the educational background and the skill of all researchers. In the last feature, we can find the references that can be seen for searching about the fatigue. It can be used for the participants to find more information about fatigue.

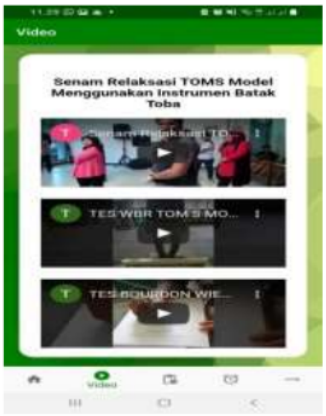

Fig. 3. The second feature

The second feature provides the participants the video as the relaxation movement. The movement from the video can be followed by the participants. The movements are easy to conduct with a comfortable music instrument. After doing this, the participants can surely feel relief from their fatigue. in this feature, we can also see how the measurement of physical fatigue and mental fatigue. the participants can get more acquainted to fatigue.

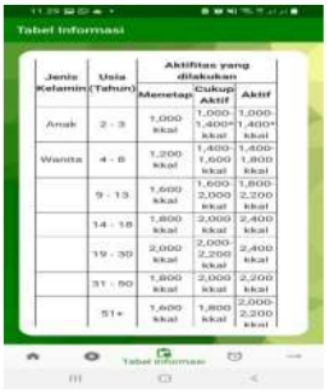

Fig. 4. Feature 3: Information Table

The third feature consists of the information table about the calories intake per person for one day. The information is classified into the gender, age, types of activities, and how many calories they spend for every activity. This feature helps the participants to count the amount of calories they should intake everyday that suit to their activities. It is important since the abundant calories will cause to bad effect.

2. Method

The participants in this study were involved in a series of treatment. Altogether there are 5 treatments which are divided into 3 big series. The first treatment is pre-test, the second is 3 treatment, and the last is pro-test.

2.1. The First Treatment

At the beginning of the treatment, all the participants were involved in a series of measuring for their physical and mental fatigue. Their physical fatigue was measured using Whole Body Reaction Test (WBRT) and the mental fatigue was measured using Bourdon Wiersman.

2.2. The second Treatment

After measuring their physical and metal fatigue for the pre-test, then the participants were asked to do relaxation for 2 weeks. They used the android-based application for doing this relaxation. After that, they were measured again. The measuring was completed for 3 times.

2.3. The Third Treatment

The last treatment is the measurement of the physical and mental fatigue. The result of this last treatment was used to see the impact of relaxation for the fatigue relief. It shows that there are significant decreasing of fatigue level after the relaxation using android-based.

3. Result and Discussion

After developing the android-based application for fatigue relief, this tool then was tested to some participants. The mental and physical fatigue then was measured from the participants. They were measured before and after using the android-based application for fatigue relief. the results can be seen from the following tables.

Table 1. Physical fatigue in audio

category	Pre-test		treatment– 1		treatment - 2		treatment – 3		Post-test	
	n	%	n	%	n	%	n	%	n	%
Normal	0	0	0	0	1	2.44	1	2.44	5	12.20
Mild	15	36.59	22	53.66	25	60.98	35	85.37	35	85.37
Medium	23	56.10	19	46.34	15	36.59	5	12.20	1	2.44
Heavy	3	7.32	0	0.00	0	0.00	0	0.00	0	0.00
Total	**41**	**100**	**41**	**100**	**41**	**100.00**	**41**	**100.00**	**41**	**100.00**

The table above shows the results of measuring audio physical fatigue levels during the pre-test, 3 times treatment, and post-test. During the pre-test in the low category, the audio physical fatigue level was 36.59% (n=15), the medium category was 56.10% (n=23), and the high category was 7.32% (n=3). After doing treatment-1, the level of audio physical fatigue in the low category increased to 53.66% (n=22), the medium category decreased to 46.34% (n=19), the high category decreased to 0% (n=0) and stable until the post-test results. In treatment-2, the normal category increased to 2.44% (n=1) and was stable until treatment-3. The low category increased to 60.98% (n=25), while the medium category decreased to 36.59% (n=15). In treatment-3, the low category increased to 85.37% (n=35) and was stable until the post-test. Furthermore, the medium category was reduced to 12.20% (n=5). In the post-test, the normal category increased to 12.20% (n=5), and the medium category decreased to 2.44% (n=1).

Table 2. Physical fatigue in visual

Category	Pre-test		treatment– 1		treatment - 2		treatment – 3		Post-test	
	N	%	n	%	n	%	N	%	n	%
Normal	0	0	0	0	0	0	0	0	1	2.44
Mild	6	14.63	17	41.46	22	53.66	27	65.85	34	82.93
Medium	19	46.34	23	56.10	19	46.34	14	34.15	6	14.63
Heavy	16	39.02	1	2.44	0	0.00	0	0.00	0	0.00
Total	41	100	41	100	41	100	41	100	41	100

The table above shows the result of measuring the level of visual physical fatigue during the pre-test, 3 treatments, and post-test. In the low category of pre-test, the level of visual physical fatigue was 14.63% (n=6), the medium category was 46.34% (n=19), and the high category was 39.02% (n=16).

After doing treatment-1, the level of visual physical fatigue in the low category was increased to 41.46% (n=17), the medium category was increased to 56.10% (n=23), and the high category was decreased to 2.44% (n=1). In treatment-2, the low category was increased to 53.66% (n=22), the medium category was decreased to 46.34% (n=19), the high category was decreased to 0% (n=0) and was stable until the post-test. In treatment-3, the low category increased to 65.85% (n=27), while the medium category was decreased to 34.15% (n=14). Lastly, in the post-test results, the normal category was increased to 2.44% (n=1), the low category was increased to 82.93% (n=34), and the medium category was decreased to 14.63% (n=6).

Table 3. Mental fatigue in working speed

Category	Pre-test		treatment– 1		treatment - 2		treatment – 3		Post-test	
	n	%	n	%	N	%	n	%	n	%
Good	37	90.24	40	97.56	40	97.56	41	100.00	41	100.00
Fair	3	7.32	1	2.44	1	2.44	0	0.00	0	0.00
Adequate	1	2.44	0	0.00	0	0.00	0	0.00	0	0.00
Total	41	100	41	100	41	100.00	41	100.00	41	100.00

The table above shows the results of measuring mental fatigue at work speed levels during the pre-test, 3 treatments, and post-test. In the good category of pre-test, the level of mental fatigue at work speed was 90.24% (n=37), the fairly good category was 7.32% (n=3), and the fair category was 2.44% (n=1). After doing treatment-1, the good category was increased to 97.56% (n=40) and was stable until treatment-2. The fairly good category was decreased to 2.44% (n=1) and also was stable until treatment-2. In the fair good category, the level of mental fatigue at work speed was decreased to 0% (n=0) and was stable until the post-test. Furthermore, in treatment-3, the good category was increased to 100% (n=41) and was stable until post-test. Meanwhile, the fairly good category was decreased to 0% (n=0) and was stable until post-test.

Table 4. Mental fatigue in working accuracy

Category	Pre-test		treatment– 1		treatment - 2		treatment – 3		Post-test	
	n	%	n	%	n	%	n	%	n	%
Good	0	0	1	2.44	1	2.44	2	4.88	8	19.51
Fair	0	0.00	2	4.88	6	14.63	12	29.27	13	31.71
Adequate	27	65.85	35	85.37	33	80.49	27	65.85	20	48.78
Doubtful	14	34.15	3	7.32	1	2.44	0	0.00	0	0.00
Total	41	100	41	100	41	100.00	41	100.00	41	100.00

The table above shows the results of measuring the level of mental fatigue on the level of work accuracy during the pre-test, 3 treatments, and post-test. In the good category of pre-test, the level of work accuracy is 0% (n=0), in the pretty good category the level of pre-test is in the same presentation, namely 0.00% (n=0). Then in the sufficient category, the level of pre-test was 65.85% (n=27), and in the doubtful category the level of pre-test was 34.15% (n=14). Then after doing treatment-1, the presentation level of work accuracy increased to 2.44% (n=1) and the presentation rate continued to be stable until treatment-2, then in treatment-3 it continued to increase to 4.88% (n=2), so that the level of work accuracy categorized as good after undergoing 3 treatments was 19.51% (n=8).

In the good enough category, after doing treatment 1, the presentation of fatigue on accuracy in work increased to 4.88% (n=2), then increased to 14.63% (n=6) after undergoing treatment 2, lastly, after

undergoing treatment 3, the level of fatigue increased to 29.27 (n=12). So that the results of mental fatigue at the level of work accuracy are 31.71% (n = 13).

In the sufficient category, after treatment 1, 85.37 (n=35), then after treatment-2, the presentation decreased to 80.49 (n=33). And in the last treatment, the presentation increased to 65.85 (n=27). So that the level of mental fatigue in the test in this category is 48.78 (20).

In the doubtful category, after treatment 1, the level of accuracy decreased to 7.32 (n=3), then continued to decline after treatment 2 and 3, namely 2.44% (n=1) and 0.00% (n=0). So the number on the post-test shows 0.00% (n=0)

Table 5. Mental Fatigue in working consistency

Category	Pre-test		treatment– 1		treatment - 2		treatment – 3		Post-test	
	n	%	n	%	n	%	n	%	n	%
Good	0	0	2	4.88	5	12.20	10	24.39	24	58.54
Fair	1	2.44	15	36.59	22	53.66	23	56.10	15	36.59
Adequate	23	56.10	18	43.90	11	26.83	7	17.07	2	4.88
Doubtful	17	41.46	6	14.63	3	7.32	1	2.44	0	0.00
Total	41	100	41	100	41	100.00	41	100.00	41	100.00

The table above shows the results of measuring mental fatigue at the level of work consistency. In the good category, the level of consistency before the test or pre-test was 0% (n=0), then after undergoing treatment-1, it increased to 4.88% (n=2), and continued to increase after undergoing treatment 2 and 3, which was 12.20 % (n=5) and 24.39% (n=10), so that mental fatigue at the level of work consistency in the good category is 58.54% (n=24)

Then in the good enough category, before doing treatments, the level of work consistency was at 2.44% (n = 1). After undergoing treatment 1,2, and 3, the level of fatigue in this test increased to 36.59% (n=15), 53.66% (n=22) and 56.10% (n=23). So that the final result obtained in this category is 36.59% (n=15).

Furthermore, in the sufficient category, the level of mental fatigue was at 56.10% (n=23) before doing treatments. Then in treatment-1 it decreased to 43.90% (n=18) then continued to decrease to 26.83% (n=11) and 17.07% (n=7) after doing treatments 2 and 3 in work consistency is 4.88% (n=2).

Finally, in the doubtful category, the level of fatigue in the pre-test was at a presentation of 41.46% (n=17). Then after undergoing treatment 1,2, and 3, the level of mental fatigue on work consistency continued to decrease to 14.63% (n=6), 7.32% (n=3) and 2.44% (n=1). So that the post-test obtained 0.00% (n = 0).

4. Conclusion

The application, named TOM'S MODEL for relaxation that have been developed, contributes a lot to the efforts for decreasing fatigue level. This application is located in smartphones. The results of the study show that there is significant decreasing of physical and mental fatigue after the participants use android-based relaxation application. It means that the relaxation has been proved for reducing the fatigue level among the workers. Based on the interview, it is found that the traditional instrument really helped them feeling relaxed. In line with the instrument, the movement is also easy to imitate. They can do it easily. Using the android-based application is also very effective since all the participants have android. They do not need another device for doing relaxation since it has been integrated in their smart phones. This application can be applied widely among the workers and any other people so that many people can get the benefit of this application.

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