

The Development of Android-Based Tom's Models to Reduce Physical Fatigue for Employee at UPT TIK and FIK Universitas Negeri Medan

Syamsul Gultom ⁽¹⁾
Sport Science
State University of Medan
Medan, Indonesia
syamsulgultom@gmail.com

S. Harahap ⁽²⁾
Physical Education Health and Recreation
State University of Medan
Medan, Indonesia

Dewi Endriani ⁽³⁾
Sports Coaching Education
State University of Medan
Medan, Indonesia

Abstract—Fatigue is a condition of being tired which is brought about by an excess of mental and physical work. This condition results in lowering or impairment of human functioning. Many workers experience fatigue during their time in the office. This fatigue condition should be reduced to improve the employee performance. therefore this study was aimed to find the alternatives of preventing fatigue when working on a computer for too long. The study was conducted on computer user employees at UPT TIK and FIK Universitas Negeri Medan. The model used is an Android-based TOM'S MODEL that contains explanations, benefits and procedures for muscle relaxation techniques using music. The types of instruments were used came from Batak Toba instrumental, that is flute, harp, garantung and taganing. The results of this research showed that the respondents' physical fatigue which measured by Whole Visual-Body Reaction Tester (WBRT) after applied the Android-based TOM'S MODEL was reduced compared to before applied. Based on these results, Android-based TOM's model can reduce employee physical fatigue.

Keywords: *physical fatigue, android-based tom's model, batak toba instrumental*

I. INTRODUCTION

Occupational health is a specialization in health science which aims to improve the highest degree of health both physically and mentally with a preventive and curative effort towards diseases caused by work and work environment factors. Law Number 36 of 2009 concerning Health regulates the rights and obligations of every citizen in maintaining and improving health status. The Act also states that occupational health efforts are one of the health efforts, which are held to realize optimal work productivity in line with workforce protection [1].

Human life cannot be separated from activity. In its activities, the body has the ability to adjust for a long time and has resistance to fatigue. But this ability has a threshold value, so that under certain circumstances can be reduced or can not

be maintained anymore. For example, if the activity is carried out continuously with high load or for a long time, it will arise tired [1].

Fatigue is a body's protective mechanism so that the body is protected from further damage resulting in recovery after rest. Fatigue is regulated centrally by the brain. In the central nervous system there are activation (sympathetic) and inhibitory (parasympathetic) systems. The term fatigue usually indicates different conditions of each individual, but all lead to loss of efficiency and decreased work capacity and endurance. Muscle fatigue is a tremor in the muscles / feeling of pain in the muscles. Medium general fatigue is usually characterized by a reduced willingness to work caused by monotony; intensity and duration of physical work; environmental conditions; mental causes; health status and nutritional state [2].

Fatigue is a problem that needs attention. All types of work, both formal and informal, cause work fatigue. Work fatigue will reduce performance and increase work errors. Declining performance is tantamount to declining work productivity. If the level of productivity of a workforce is disrupted due to physical and psychological fatigue, then the consequences will be felt by the company in the form of a decrease in company productivity [3].

[4] Mentions that for repetitive work and long static work postures, short breaks must be given (micro breaks) and during breaks workers must stand to relax muscles and walk around the workplace. This can restore muscle stiffness / strain due to work.

From previous studies it was found that internal factors (individuals) such as: age, years of work and nutritional status of health and nutritional status have a relationship to the occurrence of work fatigue. This opinion is also supported by Tarawa (2010) that a person's work capacity will decrease up to 50% at the age of > 60 years when compared to work

capacity at the age of 25 years. Decreasing the work capacity of each individual will reduce the ability to work and result in feelings of fatigue will quickly arise.

Work fatigue is also experienced by employees at State University of Medan. These workers use computers in their daily work. Therefore the study sought to find out the level of stress experienced by workers at State University of Medan especially in the faculty of sports science. The results of interviews conducted with many employees who experience mental fatigue and physical fatigue due to the impact of the use of a monotonous computer, static, high workload and a long duration of time.

Previous research TOM'S MODEL collaborates between traditional Batak Toba instrumental and muscle relaxation techniques that can affect the level of fatigue for computer users, while in this study TOM'S MODEL will be developed using an android application that previously only uses DVDs, so that employees of computer users are more efficient and flexible doing independently so as to reduce the level of fatigue.

The results of interviews conducted with UPT TIK Medan State University employees who experienced a lot of mental fatigue and physical fatigue due to the impact of the use of monotonous, static computers, high workloads and long duration of time. This has encouraged researchers to conduct research on the Development of Android-Based TOM'S MODEL to Reduce Fatigue Levels in Employees at UPT TIK Medan State University.

II. REVIEW OF LITERATURE

A. Work Fatigue

Work fatigue shows different conditions of each individual, but all lead to a loss of efficiency and decreased work capacity and endurance [5]. Fatigue is a variety of circumstances accompanied by a decrease in efficiency and endurance at work [6]. Work fatigue will reduce performance and increase the level of work errors [7].

According to Cameron work fatigue is a complex criterion that not only concerns physiological and psychological fatigue but is dominantly related to a decrease in physical performance, a feeling of fatigue, a decrease in motivation and a decrease in work productivity[8].

Factors that Cause Fatigue at Work

The emergence of fatigue in humans is a process that accumulates a variety of causative factors that cause tension (stress) experienced by the human body [9]. [10] From proceeding states that there are two factors that influence fatigue, namely internal factors and external factors. Which includes internal factors include: somatic factors or physical factors, nutrition, gender, age, knowledge and attitude or lifestyle. Whereas included external factors are the physical condition of the work environment (noise, temperature, lighting, chemical factors (toxic substances), biological factors (bacteria, fungi), ergonomics factors, job categories, nature of work, discipline or company regulations, wages, social relations and work position or position.

[2] in [5] argues that the factors causing fatigue in the industry vary greatly, and to maintain and maintain health and efficiency, the refreshment process must be carried out under pressure (cancel out the stress). Of the many types of fatigue, the emergence of fatigue in humans is a process that accumulates from various causes and causes tension (stress) experienced by the human body.

B. Fatigue for Computer Users

Health impacts that can occur on computer users are:

1) Vision Disorders

Complaints that will result from the use of computers according to Grand jean [2] in [11] distinguish complaints from Visual Display users of two types namely:

- Visual discomfort, with symptoms of eye pain, heat, fatigue, piercing pain, and dizziness.
- Visual impairment, with blurred visual symptoms (nearsightedness and distance) blinking and double according to [12] lighting that is not well-designed will cause visual disturbance or fatigue during work. The effect of lighting that is not qualified will result in eye fatigue, mental fatigue, aching complaints in the eye area and headaches around the eyes, eye organ damage, and other eye disorders.

2) Other Disorders

Computer users in a long time will cause problems in the body, but it will also interfere with fertility in adolescents and adult men. The lumbar region, neck, shoulders and forearms are the parts of the body most commonly affected by disturbances related to posture. The pain is felt both after exposure in a short or long time. Usually the pain in the area after increasing periods of postural stress and lack of rest in the area (Pheasant, 1986).

C. Definition of Stress

Stress is a term derived from the Latin *stingere* which means "hard" (*stricus*). This term undergoes changes along with the development of continued faltering from time to time from stress, stress, stress, and stress. The development of the term stress was formulated by several experts. Each interpretation of stress offers important insights. According [13], stress in 3 categories or points of view, namely:

1. Stress as a stimulus. Stress as a stimulus is an approach that focuses on the environment. The definition of stimulus sees stress as a force or stimulus that moves the individual to produce a response to tension, where the tension, in the physical sense, changes in form.
2. Stress in response (response). Stress as a response (response) is a physiological or psychological response to a person's environment of the stressor (stressor), where the stressor is an extreme event or a potentially disturbing situation.
3. Stress as a stimulus — response. Stress as a stimulus-response approach is a consequence of the interaction between environmental stimulus with the response of the individual concerned. Stress is seen not merely as a stimulus or response, but stress is the result of a unique

interaction between the conditions of the stimulus in the environment and the tendency of individuals to respond in certain ways.

The definition describes stress in a more negative picture. However, not all stress is negative. Positive stress, expressed by Dr. Hans Se lye, it is eustress (from the Greek eu, which means good, as euphoria) which encourages in a positive sense. Eu stress is needed in our lives because it will provide motivation towards a better direction.

[14] Mentions stress as a physical, mental and chemical reaction from the body to situations that are frightening, shocking, confusing, dangerous, and worrying about someone.

D. Definition of Job Stress

[15] Defines stress as a response in adjusting which is influenced by individual differences and psychological processes, as a consequence of action. An environment, situation or event that overwhelms a person's psychological and physical demands. Thus, it can be concluded that work stress arises due to environmental demands and the response of each individual in dealing with it can be different. Problems Work stress in corporate organizations is an important symptom observed since the emergence of demands for efficiency at work. As a result of work stress that is people become nervous, feel chronic anxiety, increased tension in emotions, thought processes and individual physical conditions. In addition, as a result of work stress, employees experience several symptoms of stress that can threaten and interfere with their work performance, such as irritability and aggression, being unable to relax, unstable emotions, uncooperative attitudes, feelings of being unable to get involved, and difficulty in sleeping problems.

According to Beehr and Newman in [15] Defines work stress as a condition that arises from interactions between humans and work and is characterized by human changes that force them to deviate from their normal functions.

III. RESEARCH METHODOLOGY

The research approach used in this study is a quantitative approach. Quantitative research methods can be interpreted as a research method based on the positivism philosophy, used to examine old theories in particular populations or samples, sampling techniques are generally used randomly, data collection using research instruments, quantitative / statistical data analysis with the aim to test hypotheses which has been determined [16]. This study intends to analyze the level of work stress and the dominant factors causing work stress to non-managerial employees at PT Astra Seneca Indonesia.

The type of research determined by the researcher is based on three categories, namely the type of research based on the objectives, benefits, and time dimensions.

1) *Types of Research Based on Purpose.* This research is a descriptive study, this research aims to provide a more detailed picture of a symptom or phenomenon [17]. This study illustrates a phenomenon that occurs in the field regarding the work stress of non-managerial employees at PT AstraZeneca Indonesia.

2) *Types of research Based on Benefits.* This research is

applied research that is research that aims to use scientific knowledge that is known to apply, test, and evaluate the ability of a theory that is applied in solving practical problems [17]. The theory used is stress at work based on [18] to measure the level of work stress of non-managerial employees at PT AstraZeneca Indonesia.

3) *Types of Research Based on Time Dimensions.* This research is a cross-sectional study, a study conducted at one time. This research is only used in a certain time, and no other research will be carried out at different times for consideration [17]. This research was conducted at one time namely from March to June 2012.

The level of physical fatigue in this study was measured using a Whole Body Reaction Tester. The level of fatigue measured in this study is limited only in the form of audio and visual physical fatigue. From the measurement results, it can be explained in the following table:

IV. RESULTS

Before applying the android-based Tom's Model, the workers were measured by WBRT (pre-test). The results of their fatigue level can be shown on the table below:

TABLE I. THE PRE-TEST OF FATIGUE LEVEL

Category	Information	
	Amount	Percentage
Normal	0	0
Lighter	15	36.59
Medium	23	56.10
Weight	3	7.32
Total	41	100

After that the android-based Tom's Model was applied to the workers for a few times. Then all participants were measured using whole body reaction tester (WBRT), there are two results that can be described. The first is measuring the audio fatigue and the second is the visual fatigue. The results can be shown from the table below:

TABLE II. PHYSICAL AUDIO FATIGUE LEVEL

Category	Information	
	Amount	Percentage
Normal	0	0
Lighter	15	36.59
Medium	23	56.10
Weight	3	7.32
Total	41	100

The table above shows the results of audio physical fatigue measurements with the Audio Whole Body Reaction Tester (WBRT). At the time of the mild category pretest was 36.59% (n = 15), the moderate category was 56.10% (n = 23), and the weight category was 7.32% (n = 3). The results of measurements of audio physical fatigue with WBR are presented in the following figure.

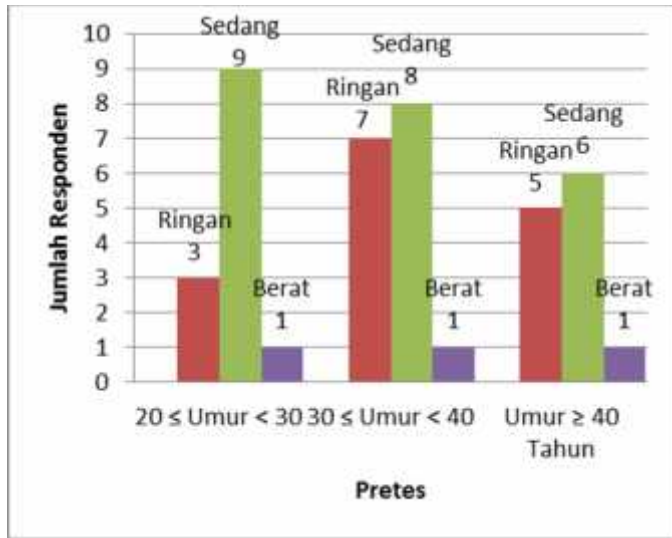


Fig. 1. Results of Measurement on Visual Physical Fatigue Level by Age

From the picture above it can be seen that many age groups in the range of 20-30 have audio fatigue. There are 9 people who experience moderate levels of fatigue. This amount is more than those who experience a severe level of fatigue of 1 person. Whereas those who have mild levels of fatigue are only 3 people. The second largest is participants in the age range 30-40. The number of participants who are experiencing moderate fatigue is as much as 8 people with a slight difference with the level of severe fatigue of 7 people. At the age of 40 years, participants who experienced moderate levels of physical visual fatigue were 6 people and mild fatigue levels were 5 people. What is interesting from the results of the measurement level of visual physical fatigue based on the age range of only 1 participant who experienced severe levels of physical fatigue.

TABLE III. THE LEVEL OF PHYSICAL FATIGUE AUDIO

Category	Information	
	Amount	Persentase
Normal	0	0
Lighter	6	14.63
Medium	19	46.34
Weight	16	39.02
Total	41	100

Based on the data table above it is known that of the 41 participants no one had a normal level of fatigue. The highest level of physical audio fatigue is around 19 people with a

percentage of 46.34%. Furthermore, there were 16 participants who experienced severe levels of physical audio fatigue. A mild level of physical fatigue occurred in 6 participants. Then with a percentage of 39.02% of participants who experienced physical audio fatigue as many as 16 people.

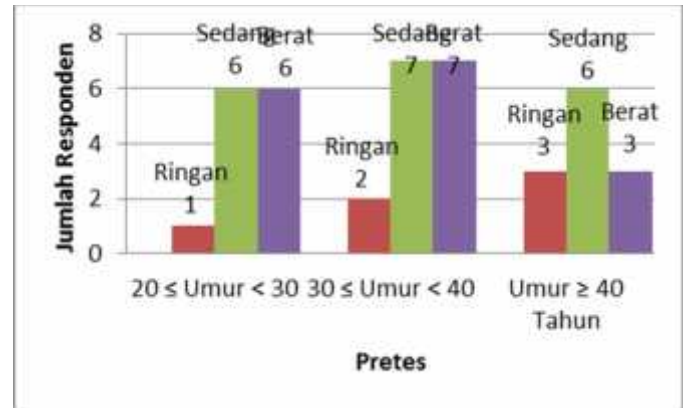


Fig. 2. Audio Physical Fatigue Level by Age

From the picture above it can be seen that many participants in age groups range of 30-40 have an audio fatigue level. There are 7 people who experienced moderate levels of fatigue. This amount is the same as those experiencing high levels of fatigue, whereas those who have mild levels of fatigue are only 2 people. The second most are participants in the age range of 20-30. The number of participants who experience moderate fatigue is as much as 6 people with the level of severe fatigue. What's interesting about the findings here is that only 1 person experienced mild physical audio fatigue. Furthermore, for the age group above 40 years, there are 3 people who experience mild physical visual fatigue. As for the level of physical fatigue of the audio, there are 6 people. 3 people experienced severe levels of physical fatigue.

V. CONCLUSIONS

From the data analysis above, it can be concluded that most of the participants experienced the medium and severe fatigue. More participants with age 20-30 years experienced the medium visual fatigue. It became finding in this study since less participants from the older age group experienced the medium visual fatigue. It also occurred on the measurement of audio fatigue in which more participants from 20-30 years group and 30-40 years group experienced the medium and severe audio fatigue. In other words, it can be said that the elder workers are more healthy than the younger workers. After applying the android-based Tom's Model, the fatigue level of all worker were decreasing.

It is very important to the university to provide an activity to reduce this fatigue for the workers, especially for the young workers. The young workers are the potential employee since they still have to run their work in long period. The older workers will be retired in ten to fifteen years later, but the younger workers will be retired in thirty to forty years later.

The condition and situation of the workplace can be one of the causes of the fatigue. Probably the younger workers get more work than the older workers. The younger workers then

have to work harder and longer in time. They have a lot of work to do at the office so it made them became more fatigue than the older workers.

REFERENCES

- [1] L. M. Kurniawidjaja, *Teori dan Aplikasi Kesehatan Kerja*. Jakarta: UI-Press, 2012.
- [2] Grandjean, *Fatigue*. In: Parmeggiani, L. ed. *Encyclopaedia of Occupational Health and Safety*, 3rd ed. Geneva: ILO, 1993.
- [3] G. Santoso, *Ergonomi Manusia, Peralatan dan Lingkungan*. Jakarta: PT. Prestasi Pustaka Publisher, 2004.
- [4] Occupational Safety And Health Administration, Labor, and U.S. Department of Labour, *Spirometry Testing in Occupational Health Programs: Best Practices for Healthcare Professionals*. 2013.
- [5] S. Tarwaka, Solichul, H.A., dan Lilik, *Ergonomi untuk Keselamatan Kesehatan Kerja dan Produktivitas*. Surakarta: UNIBA Press, 2004.
- [6] P. . Suma'mur, *Ergonomi untuk Produktivitas Kerja*. Jakarta: CV Haji Mas Agung, 1989.
- [7] E. Nurmianto, *Ergonomi Konsep Dasar dan Aplikasinya*. Surabaya: Guna Widya, 2003.
- [8] S. Ambar, *Hubungan Antara Kelelahan dengan Produktivitas Tenaga Kerja di bagian Penjahitan PT Bengawan Solo Garment Indonesia*. Semarang: Universitas Negeri Semarang-Skripsi, 2006.
- [9] S. Wignjosoebroto, *Ergonomi Studi Gerak dan Waktu*. Surabaya: Guna Widya, 2000.
- [10] Suma'mur, *Higene Perusahaan dan Kesehatan Kerja*. Jakarta: CV Haji Mas Agung, 1996.
- [11] D. J. Osborne, *Ergonomic at Work: Human Factors in Design and Development*, 3rd ed. England: West Sussex, 1995.
- [12] E. Grandjean, *Fitting the Task to the Man, 4-th ed*, 4th ed. London: Taylor & Francis Inc, 1993.
- [13] C. Kubo, "Stress and depression," *Nippon rinsho. Japanese journal of clinical medicine*. 2007, doi: 10.1146/annurev.clinpsy.1.102803.143938.
- [14] G. P. Chrousos, "Stress and disorders of the stress system," *Nature Reviews Endocrinology*. 2009, doi: 10.1038/nrendo.2009.106.
- [15] M. Larson and F. Luthans, "Potential Added Value of Psychological Capital in Predicting Work Attitudes," *J. Leadersh. Organ. Stud.*, 2006, doi: 10.1177/10717919070130020601.
- [16] sugiyono, "Metode penelitian," *Metod. Penelit.*, 2014.
- [17] B. Prasetyo and L. M. Jannah, "Metode Penelitian Kuantitatif Teori dan Aplikasi," in *Metode Penelitian Kuantitatif Teori dan Aplikasi*, 2005.
- [18] P. Greenberg, *Character development: Encouraging self esteem and self discipline in infants, toddlers, and 2 year olds*. Washington DC: National Association for Education of Young Children, 1991.