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# ISPHE

# PROCEEDINGS

**FIRST INTERNATIONAL SEMINAR ON PUBLIC HEALTH AND EDUCATION**

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**PUBLIC HEALTH DEPARTMENT  
FACULTY OF SPORTS SCIENCE  
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# FIRST INTERNATIONAL SEMINAR ON PUBLIC HEALTH AND EDUCATION (ISPHE) PROCEEDINGS

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# PREFACE

Assalamu'alaikum warrahmatullahi wabarakatuh

Firstly, may we made our highest praise and thank to Allah The Almighty, for His bless so that we are able to conduct such an precious moment; First International Seminar on Public Health and Education 2014 in Semarang Indonesia, to share our knowledge and ideas with so much warm and friendship from worldwide public health and education community.

International Seminar on Public Health and Education 2014 is aimed to gather all of experts, researchers, academicians and practitioners in health education field in general as well as national and international level in one prestigious academic forum which to discuss all health-education-related issues, ranging from human resources, curriculum, institutionalization etc. The seminar also proposed to contribute to the focus of health development direction; by considering also situation and the status of local health condition from each region, both national and regional levels as well as its relation to global health trends

I would like to deliver our highest respect and appreciation to our honorable speakers, Prof. Dr. Ir. H. Musliar Kasim, M.S (Indonesia vice Minister of Education and Culture for Education Affairs) and to the Rector of Semarang State University for their support and appreciation on this seminar; and my deep gratitude to our honorable guests: Prof. Doune Macdonald (Queensland University Australia), Maria Consorcia LIM Quizon, MD (South Asia Field Epidemiology and Technology Network, Inc , Philippine), Dr. Khancit Limpakarnjanarat (WHO Indonesia Representative), and also Assist. Prof. Dr. Songpol Tornee (Srinakharinwirot University, Thailand). I really expect that this seminar will be beneficial for all of us and to the development of the Public Health and Education field.

Allow me to express my gratitude to the participants and audiences from Indonesia and other foreign countries who are enthusiastic in attending this seminar. I do hope that all audiences will gain important values and collaborate it into our own fields and make significant changes in the future. Besides that, I also convey my appreciation to all of organizing committee who has given their outstanding commitment for presenting this occasion.

Wassalamu'alaikum warrahmatullahi wabarakatuh

Sincerely yours

**Rudatin Windraswara**



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## TOHEREN LIGHTING STANDARD AND FACTORS AFFECTING FATIGUE EYE FOR THE CRAFTSMEN KARAWO IN DISTRICT GORONTALO

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### Abstract

**Introduction:** Lighting conditions in the work environment karawo craftsmen in Gorontalo regency extremely unhelpful to achieve optimal productivity, so most of the craftsmen karawo eyestrain. Toheren standard lighting is used in the production room to help artisans karawo karawo while working in order to avoid eye fatigue.

**Methods:** This study aims to find the factors that influence the amount of lighting standards and standards based Toheren Flicker fusion measurements, visual acuity and Subjective Complaints for karawo craftsmen in Gorontalo regency. Observations observational probability sampling against 71 people craftsmen karawo in Gorontalo regency. Result obtained by stratified random sampling, divided into predictor variables consisted of craftsmen karawo characteristics, work space, lighting and materials or work materials. The response variable eyestrain by Flicker fusion measurements, visual acuity and Subjective Complaints. Descriptive data analysis, modeling analysis used iferensial Adaptive Regression Spline.

**Results:** The results showed before working craftsmen karawo not experienced eye fatigue, but after working all craftsmen decreased visual acuity and the eyes become tired. Conclusion: The use of lighting intensity above 270 lux at work craftsmen karawo not cause eye becomes tired that productivity increased.

**Key Words:** Lighting standards, toheren, eye fatigue and craftsmen karawo.

### Introduction

Small industry and handicrafts that are being developed in the province of Gorontalo is karawo craft industry which is usually done by women. Karawo embroidery industry in Gorontalo can be aligned with another craft that developed in Indonesia, so it can be a source of pride and cultural richness of Indonesia. In addition to cultural values, karawo also has considerable potential economic value, therefore it is necessary to empowerment through the promotion and development of small industries.

Karawo is a traditional embroidery. It's a craft that has been passed down from the 17th century around the year 1713. Karawo embroidery comes from the word Mokarawo that meant slicing or hollow. This naming according to the manufacturing technique of karawo embroidery where where yarns fiber embroidered on the fabric as a medium will be sliced or perforated yarn fiber by pulling on the fabric medium to be used.

By looking at data from the Industry and Cooperatives of Gorontalo District in 2010 karawo craftsmen has reached 67 businesses who formed the group of centers aim to facilitate the development of karawo handicraft industry. Based on the above there are basically two main aspects for business development in order to increase the production of the worker and the work environment. The working environment should be handled in such a way that it becomes conducive for workers to carry out activities in a safe and comfortable atmosphere.



Adequate lighting and well organized will help create a work environment that is comfortable and enjoyable so that the work can maintain the excitement of working. Less lighting impacts are: (1) eye fatigue, so that reduced power and efficiency; (2) soreness Complaints in the eyes and pain around the eyes; (3) Damage of eye senses.

Observations indicate the amount of light intensity in karawo craftsmen working environment is less than 200 lux and 400 lux highest Hiola (2000) found the workspace illumination intensity of karawo craftsmen in Gorontalo city by 96.80%. This figure is below the standard of the Minister Labour Regulation No. 7 of 1964 as well as a significant correlation between the intensity of illumination and eye fatigue.

Lighting is one of the important factors in space designing (Adi, 2006). The 49.8 lux illumination intensity using was and the highest was 223.3 lux using at the administration of PT Indonesia Power UBP Semarang causes 86.4% of workers feel the results in eye fatigue (Febriana, 2012). Symptoms of Computer Vision Syndrome (headache, dizziness, blurred vision, neck pain, red eye, double vision, difficulty focusing the eyes, even fatigue) felt by workers in the layout editor of CV "X" Tembalang Semarang caused by using light intensity of 50 lux and cause glare when using the intensity of 2853 lux illumination (Hikmatyar, 2012). Eye fatigue due to the use of inadequate illumination intensity is also found in the workplace of karawo craftsmen in Gorontalo district.

The term Toheren is a combination of tohe (torch), karawo and Reni (name of researcher) as a lighting term used in indoor of karawo production. This is an effort to determine the ideal lighting standards in karawo production place in the district of Gorontalo based on measurement of flicker fusion, visual acuity and subjective complaints. This Toheren standards determined by measuring the surface area, the volume of work space, room temperature, lighting intensity, work objects, visibility, contrast and direction of light. Ways to meet the needs described above it is necessary to establish a Toheren lighting ideal standard in order to improve the quality of work and maintain craftsmen eye health. By the problems above, it is necessary to examine what factors influence the illumination of the eye fatigue and how to standardize the Toheren size for karawo craftsman. The hypothesis of this study can be formulated as follows: "There is a standard amount of Toheren illumination and factors affecting the eye fatigue by measuring flicker fusion, visual acuity and subjective complaints for karawo craftsmen in Gorontalo District".

## Methods

### Research design

This research is observational, ie to assess Toheren Standards for craftsmen karawo in Gorontalo district. The design of this study conducted a cross-sectional, which is conducted through four phases: (1) Observation and study of reference regarding karawo craftsman industrial lighting systems; (2) Research on the respondent. At this stage the results of the observation and study of reference in the first stage used as the draft of the interview guide to determine the



Toheren factor variable for the karawo craftsmen in Gorontalo district; (3) Assessment of respondents eyestrain accuracy rate using flicker fusion gauges, Snellen card, and questionnaires; (4) Determine the Toheren lighting standards for karawo craftsmen in Gorontalo district.

#### **Data collection methods and data sources**

Based on the results of the initial observation, the number of karawo craftsmen in Gorontalo district totaled 503 people, then adjusted the criteria for the population to be studied, the population of which was taken by 239 people. To determine the sample size that is deemed eligible using Taro Yamane calculation formula:

$$n = \frac{N}{N(d)^2 + 1}$$

n = sample size

N = population size

d = Precision

l = sub-units strata

With a precision of 0.1 and a population (N) = 239, then the use of the above formula is: Based on the above formula the sample size can be considered representative of the population using an accuracy error of 0.10 degrees is 71 people. Sample size obtained in this study are at least 71 karawo craftsmen.

Determination of the number of research samples using a sampling technique in probability sampling technique is the stratified random sampling. Stratified random sampling is a sampling technique that is based on a group of subjects and between one group with the other groups appear to be any strata or levels. Reasons for using stratified random sampling is due to have a not homogeneous member or element of the population. Sampling from each district: (1) District of Telaga Biru =  $100/239 \times 71 = 29.70 = 30$  people; (2) District of Limboto =  $120/239 \times 71 = 35.64 = 36$  people; (3) District of Tibawa =  $19/239 \times 71 = 5.64 = 5$  people.

## **Result and Discussion**

### **Description of research variables**

Research variables consist of predictor variables such as characteristic of a craftsman, materials or work materials, lighting and work space, and the response variable that is eyestrain.

### **Factors affecting toheren lighting standards and measurement standards based flicker fusion measurement, visus, and subjective complaints**

The mapping process conducted to analyze the factors that affect the Toheren lighting standards based parameters flicker fusion, visual acuity and subjective complaints. The results of the mapping shows that the age factor and the intensity of illumination is a factor that affects the eye fatigue in all three measurements, namely Flicker fusion, Visus, and Subjective Complaints.



Factors affecting the eye fatigue on the two measurement are work period, working time, temperature and karawo motif.

**Characteristics of respondents by age, work period, working time, visus before work, flicker fusion before work, visibility, education level and use of glasses.**

The results of a descriptive analysis of the 71 female artisans of karawo craft small industries shows that the average age is 30 years old craftsman with a lifespan of 20-39 years. Average karawo craftsmen working for 2 hours. The working hours are generally adjusted by the number of orders karawo of consumers, if the number of orders increases, the craftsmen working time will also increase and vice versa. Karawo craftsmen have visual acuity values before working an average of 5/9 with 90% efficiency vision included in the category of near-normal vision. The smallest value of 6/24 visual acuity with visual efficiency of 60%, does not cause serious vision problems and the highest visual acuity 6/6 vision with 100% efficiency or also called normal vision. Measurement of flicker fusion before working on karawo craftsmen obtained the smallest value of 0.61 Hz and 1.11 Hz largest with an average of 0.81 Hz. Based on the results of flicker fusion measurements before working known karawo craftsmen not experience eyestrain.

Karawo craftsmen's eye distance to the object work while working is 15 cm to 35 cm with an average of 26 cm. If the eye has a not equal to 25 cm near point and a not the same far point, it is said to be infinite eye disorders (Grandjean, 1997; Hani, 2010). The distance between the eyes with the object of work is also influenced by the size of the motif and karawo craftsmen's individual vision conditions. Karawo craftsmen's educational level consists of 16.90% elementary school, junior high 33.80%, 46.50% high school and 2.80% S1. Karawo craftsmen who use glasses while working as much as 22% and that does not use glasses as much as 49%.

**Characteristics of respondents according to eye fatigue measurement results using flicker fusion measurement, visus and subjective complaints before and after work.**

Flicker fusion measurements before and after the work showed a decrease of 0,216 Hz, the test results statistically showed significance level of 0.000 which means karawo craftsman experienced eyestrain after work as 88.73% with flicker fusion measured values below 0.6 Hz (tired ) and as much as 11.27% above 0.6 Hz (not tired). Fatigue is supported by the lighting used does not match with the physical conditions and the working environment. Using high lighting have a positive effect on the value of the critical flicker frequency (Hsin-Chen, 2012).

By Snellen ototype category measurement, visual acuity measurement results after working was found as much as 87.33% artisan in almost normal vision category with visual efficiency of about 83%; 11.27% of low vision category, eyesight efficiency was 60%; and 1.41% very low vision category. The results of these measurements indicate that the value of decreased visual acuity after working an average of 0.215 and statistical test results showed karawo craftsmen decreased visual acuity after working with a significant level of 0.000.

Before working, all of karawo craftsmen not cause visible symptoms felt due to fatigue, but after the work is found all over (100%) the average karawo craftsman feel headache, irritation of



the eyes, double vision and pain around the eyes. After working as much as 26% of craftsmen who work less than 2 weeks experienced acute fatigue and 45% of workers who work more than 2 weeks of chronic eyestrain. Contact between the eyes with a small object and the work that is continuously refined lead to karawo craftsmen's eye pain. These complaints will increase if the lighting in the karawo craftsmen's work environment is inadequate. Subjective complaints above have the same symptoms as the result of a study of karawo craftsmen (Reni, 2000), elementary and secondary teachers in Hong Kong (Elaine, 2010) and call center workers in the Bank (Chih-Yong, Yen-Hui, Wei-Hsien, and Yu-Chao, 2010).

#### **Factors affecting toheren lightning standards and measurement standards based flicker fusion.**

ARS models indicate that the flicker fusion rate after work is influenced by the age which above 26 years karawo craftsmen; work period over 17 years and using the light intensity above 270 lux, no glare; work time is less than 2 hours at a temperature of less than 300C workspace. The results obtained from modeling is the amount of flicker fusion rate after work.

The results of the model Adaptive Regression Spline (ARS) shows that the best age karawo craftsmen based flicker fusion measurements over 26 years. Work experience is an important factor to skills in working karawo. Best work period based on the flicker fusion measurement of Adaptive Regression models Spiline (ARS) is above 17 years, but must be coupled with the use intensity of 270 lux illumination at the top so that the after working flicker fusion rate increases and karawo craftsmen not experience eyestrain.

Each craftsman karawo which has a work period less than 17 years and worked more than 2 hours in glare working condition will reduce flicker fusion rate after work or karawo craftsmen will feel the eye fatigue after work. Therefore, the ideal conditions of karawo craftsmen working time based flicker fusion is less than 2 hours. The existence of a static posture causes muscle fatigue on fingers when working beside the eye muscles because must always be seen the relatively small workpiece and depends on the karawo motive to be embroidered, this workload will be even worse when karawo craftsmen work more than 2 hours.

The intensity of illumination is very influential on all the factors that cause karawo craftsman eyestrain. In addition, eye fatigue will easily occur with karawo craftsmen age. ARS Model showed an increase in the value of the flicker fusion to work period in over 17 years when using the light intensity above 270 lux. The high level of illumination will cause glare and t visual comfort affec, and can have a negative impact not only in physiology, but also on the side of human psychology. Deficiency or excess of light would make human eyes become tired quickly (Manurutng, 2012).

Best workspace temperature estimated by flicker fusion measurements on the model of Adaptive Regression Spline (ARS), indicate when craftsmen who have work period over 17 years, working with the room temperature below 300C and not having the glare then flicker fusion rate after work will increase by 0.034 Hz. In addition, if the age of karawo craftsmen over 26 years and



works at room temperature under 310C can increase the flicker fusion rate after working at 0,010 Hz.

Based on the Adaptive Regression Spline (ARS) analysis model, workspace temperature factor used karawo craftsmen, apparently interacting with the age and working period. Excessive heat stress is an additional burden that must be considered and taken into account (Annasyiatul, Kurniawati, Sonya, and Sri, 2008). Therefore, ideal conditions at room temperature is based on the measurement of flicker fusion temperatures is below 300C.

#### **Factors affecting toheren lightning standards and measurement standards based visus.**

ARS models indicate that the value of after working visus affected by karawo craftsmen age under 29 years; working period under 13 years; working time over 1 hour; 6/24 visual acuity before work; light intensity above 350 lux, the color pink karawo; and 2, 3, or 4 thread colors karawo motives. The results of the model are expected obtained to maintain the 6/24 before work visus values at the time after work to karawo artisans not experience eyestrain. ARS model is based on the measurement of visus showed best age karawo craftsmen below 29 years. The results of measurements of visus after working an average of 6/24 on karawo craftsmen under the age of 29 years.

Best approximation estimates obtained of the ARS model showed visus impaired when karawo craftsmen have work period over 13 years. ARS model shows karawo craftsmen who have 6/24 value of visus before work will not cause a decrease in visus after work means karawo craftsmen not experience eye fatigue after work. 6/24 visus included in the category of low vision vision with was 60% efficiency vision and does not cause serious problems in vision.

ARS model is based on the measurement of visus showed that using lighting intensity above 350 lux will not cause eyestrain to karawo craftsmen. Distance between the eyes to objects of work and light intervention from around the object resulting light is not focused on the object to be seen. The quantity and quality of good lighting is determined from the level of reflection of light and lighting in the room rate ratio (Chairul, 2006).

Based on the best approach estimates based ARS modeling found that the value of visus will increase when karawo craftsmen working over 1 hour using pink color will improve the value of visus, but visual acuity will decline when the karawo craftsman work using thread more than 2, 3 or 4 color combinations.

According to LIN, Wen-Yang, Chin-Jung, and Feng-Yi, (2008) using four bright colors (red, blue, green and white) on lighting 20 lux and 340 lux, affect the level of eyestrain which subjects chose to tasks under the blue and white lights than green and red. Color perception caused by a complex interaction between the light source, the object of vision and the brain. When the color follow the changes of light then the perception of color and eye mechanism to adapt to a new point object will make the colors look similar to the light. Colors created by the light is a form of energy that can affect the mind (mood) and emotion (Mahnke, H., and Frank, 1947).



### Factors affecting toheren lightning standards and measurement standards based on subjective complaints

ARS Model showed that after work subjective complaints is influenced by karawo craftsmen age which more than 20 years or over 34 years; the education level of primary and secondary; volume of the room is less than 101.7 m<sup>3</sup>; the size of the field of work less than 0.4 m<sup>2</sup>; light intensity above 270 lux; room temperature under 32,40C; visibility more than 15 cm with 2 colors of yarn karawo motif.

The results of subjective complaints measurements showed that age above 20 years of craftsmen who work using the working field sizes below 0.4 m<sup>2</sup> will increase the value of subjective complaints but does not cause the eyes become tired after karawo craftsmen work, in which the power of eye accommodation at the age of 20 years generally has not experienced a decline in the ability and physiology of eye tissue degeneration has not yet occurred. While the age of craftsmen karawo over 34 years which working have to use the intensity of 270 lux illumination so that it can lower the value of subjective complaints that the eyes are not tired after karawo craftsmen work. Elaine (2010) found the percentage of teacher eye fatigue at the age of 21-30 years, while only 21.1% aged over 31 years was 78.9%.

Based on the classification of the type of work and minimal lighting contained in the Decree of the Minister of Health No. 1405 of 2002 on Industry and Office Occupational Health Environmental Requirements, karawo embroidery included in the category of "Routine Work" with a minimum illumination "300 Lux". While the lighting needs based on activity area according to the United Nations Environment (UNEP), karawo embroider included in the category of "interior general lighting" with lighting needs "200 Lux to 1500 Lux". Seeing both of these standards can be found illumination intensity in the karawo craftsmen workplace which do not meet the minimum requirement of 300 lux was 90.1%, while qualified above 300 lux is only 9.9%. In fact, approximately 43.66% illumination intensity used under 100 lux illumination was a standard for manual labor or simple visual and not used continuously. Lighting source karawo craftsmen used at work, namely aid of sunlight, depending on the seating position and the karawo craftsmen work space used at work. As a result, the intensity of illumination is used unevenly. The minimum amount of lighting intensity in the karawo workplace by 30 lux and 400 lux maximum with an average of 149.01 lux.

Illumination intensity that appropriate the standard very influential for sustainability of karawo craftsmen production processes at work. Effect of light intensity that below or above for karawo craftsmen complaints can lead to eye fatigue caused by excessive contraction of the eye muscles. ARS model based on the measurement of subjective complaints was found that by increasing 270 lux intensity of illumination has been able to provide good lighting at karawo craftsmen at work so it does not cause eye fatigue for karawo craftsman. I Gede's research (2012) found a significant increase in labor productivity amounted to 12.85% when using 282.69 lux intensity of illumination.



ARS model results based on measurements of subjective complaints showed temperatures below 31,400C using light intensity above 270 lux will increase the value of subjective complaints but does not cause eye fatigue to karawo craftsmen. According to Ilyas and Sidarta (2006) a person difficult to see at close range when he was 40 years old, in this age, accommodation range at the closest point is 25 cm and if using the maximum accommodation would cause the eyes tired. The distance the eye that too near (30 cm to 50 cm) with a working object can cause visual discomfort so that the eye muscles become tired because work continuously and be forced to see objects in the distance is too close (Hsin-Chieh, 2012). Therefore, based on the best models obtained ARS karawo craftsmen using eye distance of 15 cm to a 2 colors of yarn karawo motif work object and use intensity above 270 lux illumination will improve the value of subjective complaints and karawo craftsmen's eyes will not be tired.

**Factors affecting toheren lightning standards and measurement standards based flicker fusion, visus, and subjective complaints.**

Based on the results description above may be specified factors that can affect the Toheren lighting standards consists of age craftsmen, working period, working time, intensity of illumination, the level of glare, room temperature, visual acuity before work, karawo colors, karawo motifs, and karawo craftsmen eye visibility to work object.

Toheren lighting standard based flicker fusion measurements, visus and subjective complaints is the use of light intensity above 270 lux. Lighting is a necessity of life that is very important for humans. Visus at the age of 60 years need two to three times of light intensity from the age of 20 years whereas the age of 86 years requires five times the level of illumination. Older age generally require better contrast and greater lighting quality to get the same visual quality as experienced people at a younger age.

Any continuous illumination intensity increase with indefinitely will always be followed by a karawo craftsmen eyestrain decrease, but the intensity of illumination that too high is not too good because it will cause glare so karawo craftsmen will try to see by pupil constricting which will result in stress on the muscle accommodation.

Using 600 and 500 lux light intensity provide maximum satisfaction while working in front of a computer screen and 400, 500 and 300 lux on document examination room (Kiattisak, Promrak, and Kulworawanichpong, 2011). This study shows by raising the intensity of illumination can make workers, still within the normal capacity and the risk of eye fatigue can be avoided.

Eye fatigue experienced by karawo craftsmen expected to be reduced and prevented, as well as factors affecting fatigue must be repaired in accordance with the findings discussed above. Ideal conditions that have been found above is expected to be implemented by all karawo craftsmen which in Gorontalo province. The main hope the contribution of local governments to implement and disseminate benefit ratio and ideal conditions are used at work. Law of the Republic of Indonesia Number 36 Year 2009 on health, occupational health organized so that each worker can work in a healthy manner without endangering himself and the people around him, in order to



obtain optimum work productivity, in line with the labor protection program. Occupational health includes occupational health services, occupational disease prevention, and occupational health requirements. Every workplace shall hold an occupational health.

If the rate of incidence of eyestrain karawo craftsman not prevented, the tired eye condition perceived by karawo craftsman will be fatal and the risk of blindness is higher. While the benefits are produced when applying the above ideal conditions, the health status of the karawo craftsmen will increase and result in increase of good karawo craft productivity.

In effect the working conditions should be created with the best possible way to control all the factors and work environment that may affect the work and efficiency of human or machine (Evi, 2009).

### **Closing**

Based on the results of research and discussion, the Toheren standard found as follows: (1) The age average of karawo craftsmen in Gorontalo district is 30 years old, has a work period of 13 years, the working time of 2 hours, the working distance of the eye to the object 26 cm, the majority education level of middle and high school and by large do not use glasses; (2) All the karawo craftsmen eyestrain at the time before and after work so that visus impaired while flicker fusion values decreased after craftsmen do the work; (3) Factors affecting the toheren lighting standard based on the measurement of flicker fusion were age, work period, working, intensity of illumination, glare, and the temperature of the working space; (4) Factors affecting the toheren lighting standard based on the measurement of visus were age, work period, intensity of illumination, the use of fabric colors, and karawo motifs; (5) Factors affecting toheren lighting standards based on the measurement of subjective complaints were age, education level, the volume of the room, the size of the field work, the intensity of illumination, ambient temperature, distance of the eye to areas of work, and karawo motive; (6) Toheren illumination standard based flicker fusion measurements, visus and subjective complaints were using above 270-300 lux light intensity in order to increase the productivity of karawo craftsmen.

New Findings in this study is a Toheren lighting standard for karawo craftsmen in Gorontalo district which has aged 20 years and above, and the intensity of 270 lux illumination above tend to reduce eye fatigue after work; (1) Toheren standard lighting is expected to serve as a guide for entrepreneurs and karawo craftsmen in Gorontalo province; (2) Karawo craftsman expected to conduct eye health examination at an ophthalmologist periodically; (3) Toheren lighting model expected support from the government in order to improve the results of productivity, welfare, and health for entrepreneurs and karawo craftsmen.



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