

(REVIEW ARTICLE)



Evaluation of weaving craftsmen stations on lighting based on ergonomic principles

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Abstract

Evaluation is needed for traditional weaving craftsmen regarding the workstations used in work. This is necessary because traditional weaving is a cultural heritage that the weaving craftsmen community must preserve and use as a source of income. The weaving process uses simple tools by hand when working. In addition, the lighting for his workstation is only sourced from sunlight. This still has a weakness: when the weather is not supportive, such as cloudy or rainy, the light intensity automatically decreases. Of course, it impacts weaving craftsmen because it affects eye fatigue, unnatural work postures, reduced comfort, and reduced productivity. The studies conducted on several libraries and research results show that natural light must be combined with artificial light. Artificial light is added to minimize electricity costs. Lighting is designed to complement natural sunlight by providing at least 500 lumens of light while maintaining a balance between daylight and artificial light, energy efficient and ergonomically designed. The weaving process requires a light intensity of 500-1000 lux because it requires accuracy in producing a piece of woven cloth. Proper lighting that is by the work workers' conditions will reduce eye fatigue, and complaints, work postures become more natural, and increase work comfort and productivity.

Keywords: Lighting; Weaving Craftsmen; Traditional; Ergonomics

1. Introduction

Ergonomics is needed in human life to carry out its activities, especially in a job. Applying ergonomic principles in a workstation in large, medium and small industries is required to maintain comfort in doing work. Communities in Indonesia, especially Lombok, mostly do small-scale and household work, such as weaving businesses that still use simple tools and are done by hand. To be able to provide recommendations for improvements in terms of lighting, this paper discusses traditional weaving workstations based on ergonomics applications.

Ergonomics is a science that deals with human interaction and the work environment. Ergonomic interventions in home industries, such as fish craftsmen, can change work postures, reducing worker fatigue and musculoskeletal complaints [1]. Ergonomics interventions carried out on a simple and cost-effective wheel body are proven to reduce industrial risks and improve working conditions and occupational safety and health [2]. Ergonomics problems are often found in traditional weaving craftsmen in the Lombok area. This is a result of the use of tools that are still traditional and a lack of understanding of work comfort.

Traditional weaving developed in Lombok villages is the community's preservation of cultural heritage and is used to attract visiting tourists. This makes traditional weaving conservation villages a tourist destination village. From the observations made in the Lombok area, there are several villages where the people work as weaving craftsmen. These

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villages include Sukarara, Sade, Pejanggik, Pringgasela, and Semoyang. Woven products from craftsmen are often called *Songket* weaving or *Ikat* weaving. Women do weaving work. They believe that women can achieve economic independence and preserve culture and customs by weaving. The working method is still carried out traditionally using those with their own characteristics, motives and meanings that have spiritual and sacred values. Improvements are needed to maintain conditions at workstations so workers can do work effectively, comfortably, safely, healthily and efficiently. Comfort can be increased through ergonomic interventions in tool design as a result of changes in workers' work postures to become more natural [3]. Most workstations need additional lighting so that workers can do their work optimally. The tendency for lighting to be less than the standard set can impact a lack of concentration and stress at work [4].



Figure 1 Workstation of traditional weaving craftsmen

Figure 1 shows the condition of a traditional weaving workstation with women workers. Situations like this lead to unnatural working postures; the only lighting source is the sun. An uncomfortable sitting position during traditional weaving for 8 hours per day causes pain in the back and spine [5]. The sitting position is driven by non-ergonomic looms, which have an impact on the low productivity of the traditional weaving industry [6, 7]. Apart from sitting position, lighting is essential in weaving so that the eyes can see clearly and comfortably. Ergonomics application-based lighting refers to a person's relationship with the light source. This can affect the welfare and productivity of workers [8].

Based on the above, the evaluation was based on observations made of traditional weaving craftsmen. The evaluation results are expected to provide recommendations for improving workstations from lighting parameters to increase work comfort.

2. Scope and Methodology

The community needs ergonomics evaluation as traditional workers to increase work comfort, which affects productivity. In this case, the traditional workers who were the subject of the review were weavers in several villages in Lombok, Indonesia. Traditional weaving was chosen because the weaving results are used to attract tourists while preserving culture and customs. The evaluation focuses on lighting, in addition to work posture, because illumination plays an essential role in workplace health. Good lighting in the workplace encourages a reduction in the risk of work accidents and health problems and better concentration and accuracy at work [9]. The utilization of natural lighting by weaving craftsmen needs to be regulated and adapted to the conditions of their workstations. In addition, it is necessary to add lighting from other sources, such as electrical energy, to anticipate weather conditions when it is cloudy or raining so that it can continue to work. This study will apply several workstation designs with lighting that follow ergonomic principles to traditional weaving craftsmen's workstations.

3. Results and discussion

The lighting used by traditional weaving craftsmen comes from the sun because it is cheap and easy to use. The problem is that it is difficult for the craftsmen to work when the weather is cloudy or it rains. Sunlight as natural lighting is less effective than the use of artificial lighting. The intensity of the sun provides conditions that are not fixed. On the other hand, the traditional weaving process requires bright conditions related to high precision and creativity to produce excellent and artistic quality products. Lack of lighting or lousy lighting causes stress, headaches, tired eyes, physical fatigue, and accidents. In addition, too much lighting also causes stress and headaches [10]. The traditional weaving

process, namely using a loom instead of a machine, is a job that requires very high precision. Work like this requires lighting with an intensity that matches the accuracy required. Workplace lighting standards are regulated by Minister of Health Regulation Number 70 of 2016 and Minister of Manpower Regulation Number 5 of 2018 [11, 12]. Based on these regulations, weaving work traditionally requires lighting with an intensity of 500-1000 lux. The loom used is still very simple to produce sheets of cloth with artistic motifs according to regional characteristics. The work process is done by hand. Traditionally simple hand-operated looms are called *Gedogan* looms [13]. Handwoven products include *Ikat*, *Songket* and flat weaving [13].

The workstations of traditional weaving craftsmen only use light from the sun in the weaving process, as shown in Figure 1. Under these conditions, it is necessary to add artificial lighting to meet the required lighting standards, namely 500-1000 lux. Lighting should complement the ambient light by providing a lamp of at least 500 lumens with attention to the balance between daylight and artificial light; lighting should be flexible, energy-efficient and ergonomically designed [14, 15].

For the design of lighting in traditional weaving workstations, the authors have not found any, so in this paper, several lighting models are discussed that can be adapted to be applied to these weavers. Based on the ILO, lighting improvements do not always require a lot of lamps which impacts greater electricity use, but by using existing lamps, lamps must be kept clean and make the best use of natural light [10]. Figure 2 shows the lighting for close-up work, and this model can be applied to weavers.



Figure 2 Light shining directly on the work [10]

Artificial lighting, as shown in Figure 2, can be applied to traditional weaving craftsmen in addition to natural light from the sun. Utilization is adjusted according to needs, such as when it is cloudy or raining, the room is not bright enough, and things that cause less bright vision when working.

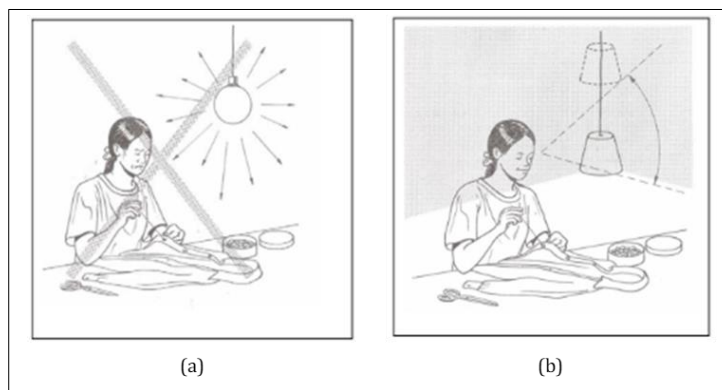


Figure 3 How to place lights to avoid glare [10]

In artificial lighting, it is necessary to pay attention to glare by how the lights are placed, as shown in Figure 3. Glare can come from direct light or reflections from equipment or surfaces. Glare can cause eye strain, fatigue and discomfort, leading to decreased quality, increased errors and decreased productivity [10]. Research conducted in the village of

Ternate found that in addition to workload, length of work, and length of work, MSDs complaints and eye fatigue in Ikat workers are influenced by the level of lighting in the workplace [16].



Figure 4 Mixed lighting 3D model [18]

Appropriate light intensity depends on creating worker safety, recognizing details and preventing eye strain [17]. The mixed natural and artificial lighting design shown in Figure 4 can also be used as a reference for traditional weaving workstations. Improper lighting results in poor vision, difficulty seeing objects, glare, poor working posture, and increased risk of injury.

Mixed light assessment must be considered with a minimum value of 300 lux and a daylight factor of 1.5% for side lighting [18]. The ILO mentions simple rules for lighting, including making full use of daylight; choosing a suitable visual background for walls, ceilings, etc.; the best place for the light source so as not to glare; using proper lighting devices and fixtures; avoiding shadows; cleaning and maintenance of lights and windows regularly [10]. Good lighting for the plant as whole and individual workstations can reduce errors and increase productivity. The same is expected to happen to the traditional weaving workstations with a redesign of the lighting system by utilizing natural and artificial light.

4. Conclusion

Based on a review of several literature and research results, it can be concluded that the lighting system at the traditional weaving workstation needs to be redesigned by utilizing natural and artificial light. This combination is needed to increase light intensity by minimizing electricity costs using artificial light. Proper lighting in accordance with the conditions of work performed by workers will reduce eye fatigue and complaints, make work postures more natural, and increase work comfort and productivity. In addition to the lighting factor, it is necessary to change the work posture of the workers because the looms used are still very simple. The working posture due to the work tool can be done by redesigning the work loom through the worker's participation to fit the body dimensions of the worker concerned.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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