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The Effect of Lighting Intensity and Music Genre on the Productivity of Creative Workers: A Case Study at Shutterhood Creative Office

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ABSTRACT : A comfortable work environment is a critical factor in supporting worker productivity, especially in creative industries that require high levels of concentration and precision. This study aims to analyze the effects of light intensity and music genre on the productivity of workers at Shutterhood Creative, a creative service company engaged in photography, videography, and content design. The research method used is an experimental factorial design (4×3), involving two factors: light intensity (90, 100, 110, and 300 lux) and music genre (jazz, pop, and rock). A total of 8 participants were involved in 12 treatment combinations. Productivity was measured based on the quantity of photo editing tasks completed within a 30-minute session, and subjective fatigue levels were assessed using a Likert scale questionnaire. The results show that light intensity has a significant effect on productivity, with the optimal level found at 110 lux. While the music genre did not show a statistically significant effect, jazz music descriptively provided better comfort and lower perceived fatigue. The interaction between both variables was not statistically significant. These findings highlight the importance of proper lighting and auditory atmosphere settings as part of cognitive ergonomics in creating a productive and comfortable work environment.

Keywords - cognitive ergonomics, light intensity, music genre, work environment, work productivity

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1. INTRODUCTION

Human–computer interaction is an activity frequently encountered in everyday life. Along with technological advancements, more tasks are carried out using computers, including photo editing, video editing, and other creative work. Workers whose jobs are almost entirely computer-based and who often work for extended periods each day tend to experience boredom, as their tasks are often repetitive and monotonous [1]. A lack of comfort in working conditions can affect employee motivation and productivity, leading to fluctuations in work performance and unstable behavior [2].

Work performed in front of a computer is generally monotonous and demands high mental effort, which has the potential to cause significant stress [3]. Such repetitive work can result in psychological fatigue, which in turn reduces concentration and productivity, and increases the likelihood of errors in editing. One way to alleviate fatigue is by improving the work environment, including providing adequate lighting and selecting comfortable music genres [4].

According to Lewa and Subono [5], a pleasant work environment can make employees feel at ease while performing their duties and enable them to achieve optimal results. Inadequate lighting, however, can lead to health problems for workers, one of which is eye fatigue [6]. Light is a visual stimulus that activates areas of the brain's cortex, influencing circadian rhythms, mood, and alertness levels [7].

In addition to lighting intensity, creative workers also benefit from a supportive work atmosphere, such as working with certain types of music [8]. Music can influence productivity through relaxation, which generates enthusiasm for work and fosters effective and integrated collaboration [9].

A study by Buraga and Dospinescu [10] examined the influence of music on students using an interactive modeling approach combined with statistical analysis via ANOVA and post-experiment data. The results indicated that music had a significant impact on students' cognitive abilities in various contexts [11].

Shutterhood Creative is a creative services company providing photography, videography, graphic design, and social media management. The company typically handles projects such as product shoots or videos, weddings, graduations, corporate social media content, and company profiles. While some projects are completed on-site, much of the editing and content creation is done at the Shutterhood Creative office. Creative workers often operate in visually intensive environments, where comfortable office lighting is essential for producing and delivering visually appealing, high-quality work.

Based on these conditions, this study focuses on the effect of lighting intensity and music genre on the productivity of workers at the Shutterhood Creative office. The research was conducted through direct observation of respondents working on computers. The respondents consisted of eight office employees who participated in twelve treatments. The observed work involved editing graduation photos, with productivity measured as the quantity of photos edited within a given period.

Boredom levels were assessed through questionnaire data collected after each experimental session. This study employed a Design of Experiments (DOE) with a Factorial Design involving two factors—lighting and music—arranged in a 4 × 3 design. The resulting experimental data were analyzed using the Analysis of Variance (ANOVA) method.

2. METHODOLOGY

2.1 Sample

This study was conducted at the Shutterhood Creative office, located at Jl. Ki Ageng Mangir Gang II No. 22, Penumping, Laweyan, Surakarta. Several supporting applications were utilized during the research process: Microsoft Word for report preparation, Microsoft Excel for organizing observational data, and SPSS for statistical data analysis.

2.2 Problem Identification

The research began with identifying the core issue — the low productivity of creative workers caused by boredom and fatigue during work. Observations at Shutterhood Creative revealed uneven distribution of lighting intensity across the workspace and unregulated variation in music genres. These factors can influence employees' psychological conditions and overall work performance [12].

2.3 Problem Formulation

Following the initial problem identification, it became evident that standardized lighting intensity and appropriate music selection are crucial for workplace comfort and performance [13]. Current lighting conditions at Shutterhood Creative are inconsistent with office lighting standards, and work comfort is also affected by the choice of music genres. This study therefore aims to explore the optimal combination of lighting intensity and music genre to enhance worker productivity during operational hours, with productivity measured by the quantity of tasks completed. To achieve this, experimental simulations will be conducted to compare various combinations of lighting levels and music genres.

2.4 Research Objectives and Benefits

The main objective of this study is to determine the effect of lighting intensity and music genre on worker productivity at Shutterhood Creative and to identify the most optimal combination to improve performance.

From a theoretical perspective, this research seeks to contribute to the understanding of how lighting intensity and music genre influence creative worker productivity, and to provide empirical evidence that non-compliance with government lighting standards can reduce productivity. From a practical standpoint, the findings can guide improvements in both office lighting and music arrangements to create a more productive and comfortable work environment at Shutterhood Creative.

2.5 Research Scope

Defining the research scope helps narrow the focus and direct decision-making throughout the study. This research is limited to evaluating lighting intensity levels and music genres suitable for implementation at Shutterhood Creative to improve workplace productivity.

2.6 Data Collection Stage

The next stage of this research involved the process of gathering the required data. Prior to data collection, an experimental design concept was prepared, followed by the implementation of the data acquisition procedure.

2.6.1 Experimental Design

This study applied two experimental factors, each with multiple levels. Factor A (lighting intensity) consisted of four levels: 90, 100, 110, and 300 lux, while Factor B (music genre) consisted of three levels: jazz, pop, and rock. Thus, the experimental setup followed a 4 × 3 factorial design.

2.6.2 Problem Statement

The experimental units were lighting intensity and music genre. The aim was to investigate whether different combinations of these factor levels influenced worker productivity. Productivity was measured as the quantity of work completed within a fixed time frame.

2.6.3 Response Variables

The response variables in this study were:

1. Work output quantity — number of photo edits completed within a 60-minute session.
2. Comfort score — measured using a 1–5 Likert scale questionnaire.

A total of 8 creative workers at Shutterhood Creative participated. Each participant was exposed to randomized combinations of treatments to minimize carry-over effects, with each combination replicated at least twice.

2.6.4 Independdent Variables (Factors)

1. Lighting intensity (90, 100, 110, 300 lux)
2. Music genre (jazz, pop, rock)

2.6.5 Controlled Variables (Restrictions)

To ensure that non-experimental factors did not bias the results, several conditions were standardized:

- Workstation ergonomics were adjusted for comfort.
- Workspace layout ensured adequate movement space.
- Office wall colors avoided extreme contrasts.
- Monitor brightness was calibrated equally across all setups.

2.6.6 Factor Levels

- Factor A (Lighting): A1 = 90 lux, A2 = 100 lux, A3 = 110 lux, A4 = 300 lux
- Factor B (Music): B1 = Jazz, B2 = Pop, B3 = Rock

The total number of treatment combinations was 12, each applied to 8 respondents, with 1 replication.

3. RESULT AND DISCUSSION

3.1 Normality Test

Normality testing was conducted on the complete dataset obtained from the experimental trials involving the combinations of lighting intensity levels and music genres. The purpose of this test was to determine whether the experimental results followed a normal distribution.

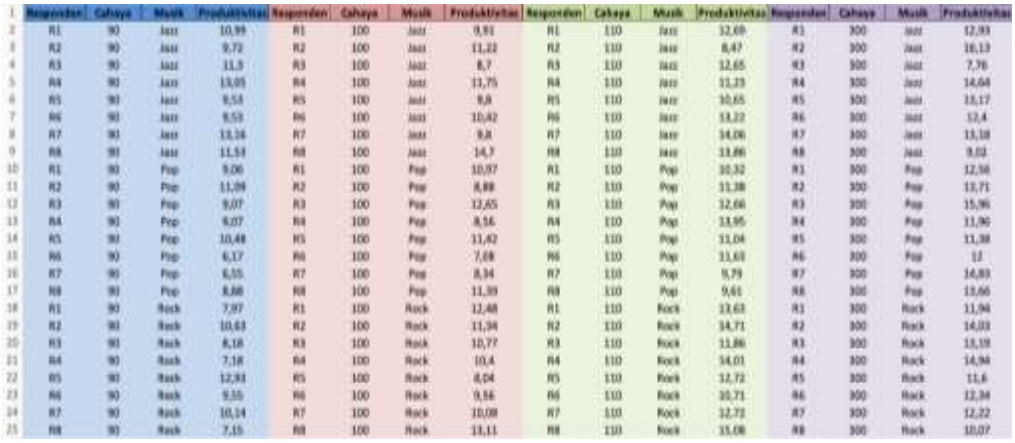

Figure 1. Normality Test

The Shapiro–Wilk test was employed to evaluate the normality of the photo-editing productivity data for each treatment combination. This step is crucial because ANOVA, as the primary statistical analysis method in this study, assumes that the residual data are normally distributed.

The dataset consisted of 12 treatment combinations, formed from four lighting intensity levels (90, 100, 110, and 300 lux) crossed with three music genres (jazz, pop, and rock). Each treatment combination contained eight productivity data points, representing the number of photo edits completed within a 60-minute session.

The results of the normality test for each treatment combination are summarized as follows:

- All p-values from the Shapiro–Wilk test were greater than 0.05, indicating that there was insufficient evidence to reject the null hypothesis (H_0) that the data are normally distributed.
- Therefore, all data groups across the treatment combinations can be considered to follow a normal distribution, and the normality assumption required for the use of ANOVA has been satisfied.

Kombinasi Faktor	Nilai W (Shapiro-Wilk)	Sig. (p-value)	Keterangan
Cahaya 90 lux + Musik Jazz	0.956	0.769	Normal
Cahaya 100 lux + Musik Pop	0.932	0.490	Normal
Cahaya 110 lux + Musik Rock	0.951	0.717	Normal
Cahaya 300 lux + Musik Jazz	0.978	0.936	Normal

Figure 2. The Shapiro-Wilk Test

Based on the results of the Shapiro–Wilk normality test, all data in each treatment combination meet the normality assumption. Therefore, further analysis can proceed using the ANOVA method to examine the effects of light intensity, music genre, and their interaction on the productivity of creative workers in the context of visual editing.

3.2 Homogeneity Test

The homogeneity test was conducted pairwise between the results of the experimental combinations of factors (light intensity and music genre) and the quantity of work output. The purpose of this test is to determine whether the error variances for each treatment factor are equal, or in other words, whether the experimental data are homogeneously distributed across the factors. Levene's test was performed using an analysis of variance on the absolute deviations of each observation in the sample from its corresponding sample mean.

Test of Homogeneity of Variances

Dependent Variable: Produktivitas

Levene Statistic	df1	df2	Sig.
0.4058	3	20	0.9498

Figure 3. Homogeneity Test

Based on the homogeneity test using Levene's Test for productivity data across the combinations of light intensity and music genre, the following results were obtained: Levene Statistic: 0.4058; p-value: 0.9498. Conclusion: Since the p-value is greater than 0.05, the data can be considered homogeneous. This means that the variances of productivity data across all treatment combinations (light intensity and music genre) do not differ significantly. Therefore, one of the essential assumptions for ANOVA — homogeneity of variances — has been satisfied.

In this study, the independence test was carried out using a residual plot derived from the experimental results of the combined treatments of light intensity and music genre against the experiment order (sequence of data collection).

3.3 Independence Test

The independence test was performed by visualizing the distribution of residuals with respect to the experimental sequence using a scatter plot. The plot revealed that the residual points were randomly dispersed around the zero line without forming any discernible pattern. This randomness indicates that the residuals are not dependent on the sequence of experiments or the timing of data collection.

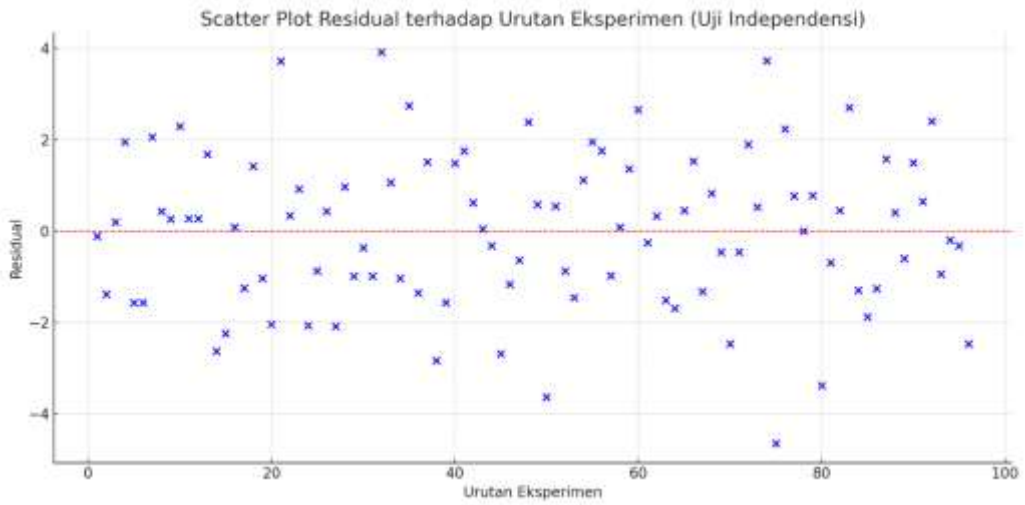

Figure 4. Independence Test

Therefore, it can be concluded that the assumption of residual independence has been satisfied. Consequently, the two-way ANOVA model applied in this research is statistically valid in terms of residual independence, and the significance tests across treatments can be accepted with a higher level of confidence.

3.4 Likert Scale Analysis

The processed data were subsequently analyzed and interpreted in accordance with the predefined analytical stages. This analysis comprised an evaluation of the processed data using an ANOVA approach, as well as an assessment of the effects of light intensity and music genre—along with their respective levels—on work productivity performance.

Cahaya (Lux)	Musik	Rata-rata Kejenuhan	Standar Deviasi	Min	Max
90	Jazz	3.25	0.89	2	5
90	Pop	4.00	0.76	3	5
90	Rock	3.88	0.83	3	5
100	Jazz	3.00	0.76	2	4
100	Pop	3.38	0.92	2	5
100	Rock	3.50	0.85	2	5
110	Jazz	2.63	0.74	1	4
110	Pop	3.00	0.82	2	4
110	Rock	2.75	0.71	2	4
300	Jazz	3.13	0.99	1	5
300	Pop	3.38	0.74	2	5
300	Rock	3.50	0.76	2	5

Figure 5. Questionnaire Data

Questionnaire data were collected from respondents after they completed each 60-minute experimental session. Each respondent rated their perceived level of boredom using a 1–5 Likert scale, where a score of 1 indicated “very low boredom” and a score of 5 indicated “very high boredom.”
The following section presents a summary of the descriptive statistics of boredom levels based on the combinations of light intensity and music genre.

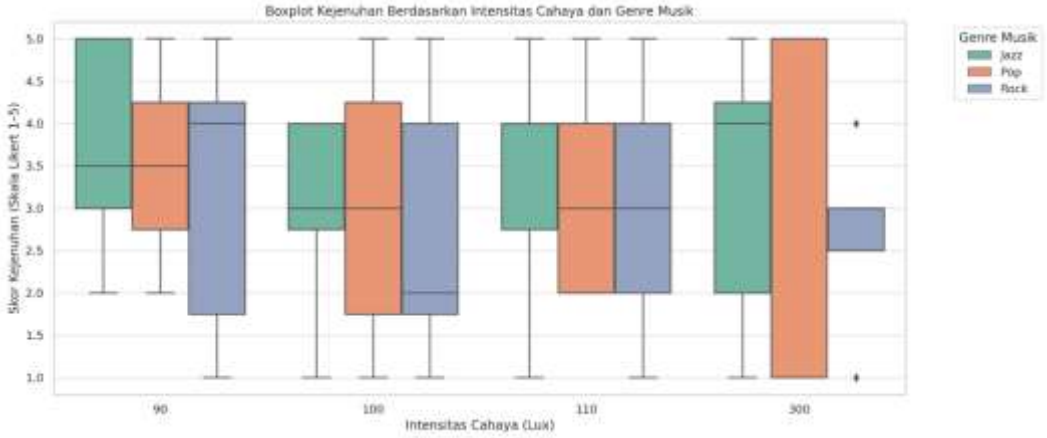

Figure 6. Boxplot

From the analyzed data, several initial conclusions can be drawn:

- The highest average level of boredom was observed under the combination of 90 lux lighting and pop music (mean = 4.00), indicating that dim lighting accompanied by pop music may lead to increased boredom among creative workers.
- The lowest average boredom level occurred under 110 lux lighting combined with jazz music (mean = 2.63). This suggests that adequate lighting paired with calm music tends to create a more comfortable working atmosphere and reduce boredom.
- An increase in light intensity from 90 to 110 lux appears to be associated with an overall decrease in boredom levels.

Based on both descriptive and inferential analyses of the boredom questionnaire data, it can be concluded that the combination of light intensity and music genre significantly influences respondents’ perceived boredom. In general, sufficiently bright lighting (110 lux) combined with soft, low-arousal music such as jazz tends to reduce

boredom, whereas excessively dim lighting (90 lux) combined with more energetic music such as pop or rock increases boredom levels.

These findings support principles of cognitive ergonomics, which emphasize that a work environment that is comfortable both visually and auditorily can enhance psychological comfort and potentially support long-term productivity among creative workers.

4. CONCLUSION

Based on the results of the experimental study conducted on eight respondents at Shutterhood Creative Office using twelve treatment combinations of lighting intensity (90, 100, 110, and 300 lux) and music genre (jazz, pop, and rock), it can be concluded that lighting intensity has a significant effect on the productivity of creative workers. A lighting level of 110 lux resulted in the highest work performance and the lowest level of fatigue, whereas insufficient lighting, particularly at 90 lux, tended to reduce productivity and increase fatigue.

In contrast, music genre did not show a statistically significant effect on productivity; however, it influenced workers' subjective comfort. Jazz music was descriptively found to be more relaxing and was associated with lower levels of fatigue compared to pop and rock music. The interaction between lighting intensity and music genre was also not statistically significant; nevertheless, descriptive analysis indicated that the combination of 110 lux lighting and jazz music provided the most comfortable and productive working condition.

Furthermore, the results of the fatigue questionnaire supported these findings, showing that the combination of 90 lux lighting and pop music produced the highest level of fatigue, while 110 lux lighting combined with jazz music resulted in the lowest fatigue level. All statistical assumptions, including data normality, homogeneity of variance, and residual independence, were satisfied, thereby confirming the validity of the two-way ANOVA applied in this study and ensuring the reliability of the statistical findings.

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