HOW ERGONOMIC FACTORS CONTRIBUTE TO EMPLOYEES’ PERFORMANCE

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Abstract: The objective of this article is to explain how ergonomic factors such as lighting, temperature, noise, and computer’s monitor can contribute to employees’ performance. This study took place in Graduate and Post-graduate Program (Pascasarjana) of Faculty of Economics and Business, University of Brawijaya. Ten informants that work as an employee in the faculty were involved in this research. Using an in-depth interview with those informants, the researcher found that ergonomic factors did contribute to the employee’s performance. We found that a comfortable room with adequate lighting, pleasant temperature, minimum noise, and the appropriate monitor can ensure employees’ comfortability in their workplace, which will also enhance their performance. Most of the employees admit that they already satisfied with what their work has to offer. These findings correlate with six indicators of performance, where quality and quantity were achieved, every job was completed on time, all facilities were able to be utilized, and all employees were able to perform team works to get the job done, without the need of being supervised. We, as a researcher, suggest that every organization should manage their working environment to become as ergonomic as possible, so that their employees may achieve higher performance.

Keywords: ergonomic, comfortable workplace, performance


Ergonomics, also known as human factors, can be defined as a study of work and the interaction between people and their environmental work systems (Wignjosoebroto, 2007). Dul and Neumann (2009) also mentioned the definition about ergonomics quoted from International Ergonomic Association (IEA), where they stated “ergonomics is concerned with the understanding of interactions among humans and other elements of a system, which by doing so, it also provide optimization for human well-being and overall performance of such system”. The optimization for human well-being can be done by giving an appropriate work environment for all the workers, based on what they need to get the job done.

Some ergonomic factors, like room temperature and lighting, did have an impact on employee
performance (Vimalanathan and Babu, 2013). It is not limited to industry worker either. The condition of working office such as its lighting, room temperature, and noises (Hameed and Amjad, 2009) and any other tools like printer or computer (Kingsley, 2012) will also affect employee performance.

Mondy (2008) said that performance management is a process, which is dedicated to ensuring that every single process in the organization was carried on, the way they are supposed to be done, to optimize the productivity of employees, teams, and the organization itself. This definition correlates with the statement from IEA Council, where one of the purposes of ergonomics is to optimize overall system performance. That is why it is important for the organization to maintain its employee’s performance so that such optimization can be achieved.

In this study, the researcher will focus on office workers instead of the industrial. We chose office workers because our object of study is a faculty of the university. To be precise, the object of our study is Pascasarjana (Master and Doctoral Program) of the Faculty of Economics and Business at the University of Brawijaya. The reason behind this is we rarely found a study where ergonomics is associated with employee performance in university. By doing so, we can contribute more to science by creating another research about ergonomics in university.

METHOD

In this research, we use a qualitative method and case study approach. Qualitative research is necessary for us to gain any important information from our informants. To make sure that we receive such information, we asked ten informants from Pascasarjana of Faculty of Economics and Business for an in-depth interview. We also enrich our primary data with observation and photograph.

For the secondary data, we use many sources. Mainly from journals of the past researcher, but we also use books and government policy about ergonomics in the workplace, so that we can have a deeper understanding of the topics. This research is conducted in the building of the Pascasarjana itself.

We chose our informants based on the characteristic that is stated by Neuman (2007), where they must be:
1. People who understand their native culture and witness events in their place.
2. People who deeply involved on activity in the research object.
3. People who are willingly giving their time for the researcher because field study requires a long time and high intensity of understanding.
4. Non-analytical people, but they completely understand every on-going phenomenon without doing analysis.

For data analysis, we follow the three steps from Sugiyono (2008):
1. Data reduction
   In this step, every data will be coded and categorized based on the appropriate aspect chosen by the researcher. Performing this step will help the researcher to determine which data is essential and who can provide even more detailed information. Later, such information will be analyzed, and ultimately yield a conclusion.

   In this research, data reduction is performed by filtering every information receiver from in-depth interviews with informants.

2. Organizing the data
   The second step is organizing the achieved data. Every information will be filtered, so the researcher can determine what the theme of the research is. In this research, organizing the data is performed by processing information that has been reduced. Through such a process, we can determine which data has a similar property of information. Every data which has similar information with the other will be grouped as one category of information. This information, which can also be called key information, will later be processed to determine its meaning. After we understand the meaning, we described it, and determine the theme for that grouped information.

3. Interpretation
   For the last step, the researcher has to identify patterns, inclination, and explanation of every
data. From themes that had been determined in the second process, the researcher can interpret it. In this research, we also make sure that those interpretations are described as clearly as possible. The yielded result from such interpretations may or may not support findings from previous researches.

Because we collected information from an in-depth interview, observations, and documentation, all data we received are recorded as texts and pictures. Creswell (2014) stated that texts and pictures are forms of data with rich information, and because of that, not every single information will be used. It is precise because of this reason we need a data reduction, to determine which information is a really important one. Through this process, the researcher will be able to organize every data and conclude themes (Creswell, 2013). In this research, the concluded themes are:

1. Appropriate lighting
2. The temperature in the workplace
3. Noises in the workplace
4. Appropriate monitor
5. Ergonomic workplace

To ensure the credibility and validity of collected information, we took a few steps based on Bungin (2003). Those steps are as follows:

1. Prolonging researcher’s participation when collecting data in the field.
2. Observe continuously and solemnly so that the researcher can gain an even deeper understanding of the current phenomenon.
3. Involve friends who are not currently joining the research to discuss, give suggestions, or even critics, from the beginning until the finish.
4. Analyzing or conducting another research in a different area and uses it as a comparison to the current study.
5. Ensure appropriateness and comprehensiveness of data analysis.
6. Discuss the research with another member of the study about data collection, interpretation, and drawing out conclusion.

We also use data triangulation method. Sugiyono (2008) define this method as collecting data from various source with similar technics. Those sources were our informants. The purpose of this method is not to seek the truth about a phenomenon. Instead, it is more focused on enhances the researcher’s understanding of what they had already found.

Regarding collecting data from various source, we collected as much information as possible about our topic of research. That information was provided by our informants and collected through the same method, which is an in-depth interview. By this act, we were able to collect a lot of data regarding our topic as well as understanding the current phenomenon in the field.

**RESULTS AND DISCUSSIONS**

As was previously mentioned, themes of this research had been determined. The reduction data process had given us the following themes:

1. Appropriate lighting
2. The temperature in the workplace
3. Noises in the workplace
4. Appropriate monitor
5. Ergonomic workplace

From those themes, we can determine propositions. In qualitative research, propositions are one of many ways which can be chosen by the researcher to make conclusions (Yin, 2011). We divided these propositions into two categories. First are minor propositions, which describe every theme one by one. Second are a major proposition, which describes all minor propositions as a whole. The minor propositions are as follows:

1. 1st minor propositions
   Good lighting design will improve employee’s performance.
2. 2nd minor propositions
   Workplace temperature affects employee performance.
3. 3rd minor propositions
   Noises heard by employees when they are working will affect performance.
4. 4th minor propositions
   Monitor condition that suitable for employees’ needs makes them do a better job.
5. 5th minor propositions
Employees can have good performance because they are supported by ergonomic workplace. While the major proposition is as follows: lighting, temperature, heard noises, and monitor condition will affect employees’ performance.

**Minor Propositions**

The first minor proposition is about appropriate lighting. Lighting in the workplace is one of many significant factors which can affect performance (Vimalanathan and Babu, 2013). Such lighting must also consider other things such as illumination, lumination, and glare.

In this research, we analyze lightings in seven different rooms, based on data from our informants. Some of those rooms have windows which let sunlight in, while the others do not. Those seven rooms are Academic Division Room, Reading Room, Secretary Room, Administrative Division Room, Financial Division Room, Lecturing Division Room, and Management of Accounting Profession Education Room (PPAk Room).

From the gathered information, we found that every one of our informants can work efficiently with the current lighting. They stated that lightings in their room are already sufficient for them, although some would prefer a brighter room. Those who prefer a brighter room are our informants from Academic Room and Public Administration Room. Those places were originally a large lobby, which later transformed into rooms. Therefore, they retain their original lighting of the lobby itself, which are a little bit darker than the other room.

We also found that it is because such appropriate lighting our informants can do their job well every day, which means that those lightings are indeed able to affect performance. This finding is relatable with another past research from many researchers, such as Vimalanathan and Babu (2013), Mango (2014), Ali et al. (2015), Hameed and Amjad (2009), and Dianat et al. (2015). Mango even stated that lighting is the most dominant factor in affecting employee performance.

One of our informants also mentioned that he is more comfortable when he was working within a room which can be reached by sunlight. This finding correlates with past research by Hameed and Amjad (2009). In their research, they stated that it is important to keep the balanced amount of both natural (sunlight) and artificial (lamps) lights.

Other past research by Tarcan et al. (2004) also stated how lighting affects performance. In their study, they found that lighting can be used as a measurement of workplace’s comfortability. The more comfortable the room, the higher the performance.

However, these findings of lighting contradict one previous research from Saleem et al. (2012). In their research, they stated that lighting has no significant impacts on performance. Whereas in this research, we found that lighting is an important factor in maintaining employee performance.

The second minor proposition is about the usage of AC in the workplace. All analyzed room have their own AC, but not every one of them uses it regularly. Some rooms have windows, and employees who worked there prefer natural air over AC.

While some rooms have available windows that allow the flow of natural air, that is not the case for a few others. Academic Room, Public Administration Room, and Secretary Room do not have windows because their position is in the middle of the building. Because of this, they regularly use AC to ensure that room temperature stays comfortable.

Rooms with windows have a different way to maintain the temperature. People in rooms with windows simply turned off their AC because they prefer natural air, which is cool enough to make the room comfortable. Despite this difference, all informants stated that they all felt comfortable in their room. They also stated it is very important to maintain room temperature because if the weather becomes too cold or hot, it will cause discomfort while working, which lead to a decrease in performance.

It is also important to mention that, of all rooms, Reading Room had the most different treatment than the others. Reading Room had the most different treatment than the others. Reading Room has a lot of books, and it is important to make sure that the temperature is cool enough to prevent molds from growing. So, despite all available windows in this room, they are always closed and only being used to help to maintain good lighting, because room temperature is being controlled by AC.
How Ergonomic Factors Contribute to Employees’ Performance

From findings in the second proposition, we can understand that room temperature do an effect on performance. If the room becomes too cold or hot, it can decrease the performance of people who work there. These findings correlate with other past research by Vimalanathan and Babu (2013), Ali et al. (2015), Tarcan et al. (2004), Saleem et al. (2012), and Dianat et al. (2015), which stated that room temperature did affect performance although these findings contradict with results from Manggo (2014), which stated that temperature had no effect on performance.

The third minor proposition is about noises. Noises are one of many things that will affect performance (Hameed and Amjad, 2009). Based on the gathered data, we found that several noises may be heard by our informants when they are working.

Most of the time, the heard noise were originated from people conversation. Every day, there is a lot of student passing by, and their conversation can be heard by our informants. Noises from the vehicle can also become an annoyance if it comes from modified exhaust, which produces a very loud sound. There was also a time when our informants heard noises from the construction site that was within or next to the Pascasarjana building. Those noises can disturb concentration and hinder employees’ performance.

While the heard noises are temporary, some of our informants stated that they could become disturbed, especially when they must working on something that requires a lot of concentration. Some other informants stated that they did not live by that. Despite all of these, every one of our informants admits that they can still get the job done, although they prefer a calm working place.

Findings from the third proposition show that noises did affect performance because it may cause concentration loss. These findings correlate with a few past research by Saleem et al. (2012), Liu et al. (2017), and Banbury and Berry (2005), where noises can affect performance. Studies by Kingsley (2012) and Dianat et al. (2015) are also relatable with our findings since they stated that heard noises could decrease employee performance.

The fourth minor proposition is about an appropriate computer monitor. A computer monitor must be taken into consideration when we talk about ergonomic (Bridger, 2003). By appropriate, it means that a monitor should be able to be adjusted by the user.

For most of the employees at Pascasarjana FEB UB, they admitted that their monitor had already very well-adjusted for everyday works. They are provided with a 14-16 inch widescreen monitor which supported high definition resolution. Only a few employees have a smaller monitor, which make them feel less comfortable compared to those with the HD one.

However, despite the smaller monitor makes them less comfortable, this does not necessarily mean hindering their performance. They are still able to finish their job. Although, if they are to be provided with a larger monitor which support the larger resolution, they may have increased in performance. It is because one of our informant, who rolled position with his workmate (thus, changing the workplace and used monitor), stated that it is easier to see at HD monitor than the square one.

Another finding of the larger monitor makes work more efficient also come from another informant. At our interview, he stated that ever since he changes his old HD monitor with the FHD (Full High Definition) one, his work can be done easier. He mainly felt this benefit when he was working with office applications and used the Show Windows Side by Side feature. It is because the larger resolution can show more information, and thus reduce his time to scroll the page up or down.

From those findings in computer monitors, we can understand that a monitor can affect performance. From statements of our informants, it is clear that, while working on the smaller monitor does not reduce performance, using the larger one would make them work more efficiently. These findings can correlate with previous studies by Czerwinski et al. (2003) and Ni et al. (2006), where they found that a larger monitor display can make anyone who uses it works faster. Research from Bi and Balakrishnan (2009) also provide a similar result.
with this study, where they stated that using a larger display with high resolution will provide the following benefits:

1. Multi-window tasks, where a user would be able to display multiple windows simultaneously in a single screen. Liu et al. (2014) also found the same thing in their research about the wall-size display.

2. Rich information tasks, where a screen with higher resolution allows an application to provide more information than the smaller one. This allows the user to reduce the time used to navigate the page scroll. Another research by Bridgeman et al. (2001) also stated the same idea.

The fifth and final proposition is about the performance itself, which is formed from the ergonomic workplace. In this research, employee performance was measured using indicators from Bernardin (2007). Those indicators are:

1. Quality, which measures performance based on pre-determined standards/procedure.

2. Quantity, which measures performance based on the amount of produced/finished goods or tasks in one period.

3. Timeliness, which measures performance based on the time needed by employees to finish their job without diminishing time for other tasks.

4. Cost effectiveness, which measures performance based on how well employees can utilize every given resource (tools, technology, human resource, etc.) to complete their job.

5. Need for supervisor, which measures performance based on how well employees in doing their job without helps from their supervisor.

6. Interpersonal impact, which measures performance based on how employees utilize their interaction with their workmates, including supervisors and/or subordinates, to ensure completion of their job.

Based on our informant’s statements, we can understand that every ergonomics aspect, such as lighting, temperature, noises, and monitor condition, can make employees maintain their everyday performance. Only a few things that are considered a little bit uncomfortable, such as a smaller monitor, tentative noises, and seemingly little darker room. Those things, however, did not decrease their performance. Although, a better facility, such as a bigger monitor or brighter room, would certainly help improve their performance.

Lightings in every room are already able to support employees in finishing their jobs. This benefit was felt especially by those who worked in a room with windows, which allow sunlight to brighten the room even more. Only two rooms (Academic and Administrative Division rooms) are considered by employees who worked there as not as bright as another room. Despite that, it does not decrease the performance of the employees who worked there.

Room temperature is also comfortable enough to help employees do their daily activity. Every room has its own AC, so they can control the temperature whenever they wish. Some employees would still prefer turning off the AC and open the windows instead, simply because they like natural air better. Although, those who worked in the room without windows would rely on AC to control the temperature. Despite the difference, both conditions can support all employees, and thus, maintain their performance as well.

Noises can become troublesome if employees need to work on something that requires concentration. However, because of its tentative nature, all employees are still able to manage the condition and finish their job correctly. Despite hearing noises, it does not necessarily mean that they cannot complete their job. Because of that, those noises did not decrease their performance, although a calm condition is more favored.

Computer monitors can also contribute to performance, as shown before. Our informants stated that their monitor is already good enough for daily use so that they can complete their job. Some of our informants have a smaller monitor compared to the others, and thus, smaller resolution. Meanwhile, there was one informant who recently changed his monitor, and he felt the benefit of having FHD resolution over the HD one, which technically can make him finish his job faster. Which means, even when smaller monitor did not decrease performance, the larger one can surely improve it.
How Ergonomic Factors Contribute to Employees’ Performance

From all those findings, we can now use performance indicators from Bernardin (2007) to assess their performance. We can say that all employees have good performance, it is because they can complete their job in time (timeliness) and based on the procedure (quality), even when they need to do a lot of tasks (quantity). They do not need to be supervised all the time either (need for supervisor) because they already understand how to complete their tasks on their own. Also, all employees can utilize every resource given to them, especially the computers and other corresponding tools, to complete their duty (cost effectiveness). We also found that their interaction with co-workers, be it superiors or subordinates, can also contribute to the completion of jobs (interpersonal impact).

Major Proposition

We stated before that our major proposition is: lighting, temperature, heard noises, and monitor condition will affect employees’ performance. Based on our findings, all of those ergonomic factors are indeed affect performance. Our description at minor propositions has already covered these findings. There are a few notable things regarding this major proposition, such as:

1. Lights from the room’s lighting can affect performance because it allows employees to see and read everything easily.
2. Room temperature can affect performance because it maintains the comfortability of the workplace. The comfortable workplace will increase employee performance.
3. Noises can affect performance. Our informants stated that noises could be really disturbing if it were heard when they need to concentrate on their job. While those noises did not necessarily make employees unable to complete their job, a calm workplace is more favored by every informant as it makes working easier, and thus, maintain the performance as well.
4. A computer monitor can affect performance. It is mainly because of the size of the monitor itself. The smaller monitor does not mean it cannot be used by employees to complete their job. But bigger monitor, which also support the higher resolution, do make employees able to work more efficiently, which in turn will also increase performance.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

From our findings and discussion, we can conclude that the application of ergonomics in Pascaasarjana of Faculty of Economics and Business, in term of lighting, temperature, noises, and monitor, has already able to support employees’ performance. This ergonomic workplace, where all of its components are made available and comfortable, can help employees to achieve higher performance. Although some management to avoid loud noises may need to be done, as it can affect performance in negative ways.

Recomendations

We would also like to give recomendations to every organization, especially to those whose employees spend most of their working time in an office room. It is recomended to maintain the room condition to become as ergonomic as possible, whether about its lighting, temperature, noises, or the computer’s monitor. It is because those ergonomic factors have their contribution to employees’ performance. Of course, such maintenance must also consider the capability of the organization as well.

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