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Ergonomic of School Facilities and Infrastructure to Support Effective Schools

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Abstract: The placement of the blackboard (LCD), the use of lighting, the size of the seats, study desks and others in schools are very important for the comfort, health and safety of students and teachers. One way that can be taken is through knowledge of ergonomic principles. The purposes of writing are: (1) reviewing and knowing the ergonomics principles of school facilities and infrastructure; (2) examine the importance of ergonomic principles in schools. Through a literature review, relevant ergonomic principles are explored to be applied to school facilities and infrastructure. The results of the study show that there are still educational staff and educators who currently do not know and understand the ergonomics principles of facilities and infrastructure, but school facilities and infrastructure are in accordance with the standards determined by the relevant education office. Through this paper, teachers are required to know about ergonomics theory for classroom facilities and infrastructure and can apply it in learning so that learning can run effectively and efficiently.

Keywords: Effective school, ergonomics, infrastructure.

Introduction

In the era of globalization, competition is getting faster and tighter accompanied by the emergence of increasingly complex problems, especially in learning that demands increasing teacher professionalism. In order to deal with increasingly fierce competition and complex problems, a teacher is required to be willing, able, and willing to change. Therefore, efforts are needed to increase professionalism, especially those related to knowledge and understanding of ergonomic principles that can be applied in the learning process.

Ergonomics is the science, technology, and art of harmonizing tools, working methods and the environment to human capabilities, abilities and limitations, so as to obtain healthy, safe, comfortable, effective and efficient working conditions and environments in order to achieve the highest productivity. 2004).

An ergonomic study room will certainly make someone feel comfortable in carrying out their activities in that space. One of the basic principles of ergonomics in design is *human-centered design.* The point is that a design should pay attention to the human factor as a user who has various limitations individually and also has variations between individuals (Iridiastadi, 2014). In addition, ergonomics is a science that in its application tries to make humans in harmony with workand the environment so that the design process must also be in accordance with the size of the human body that uses it (Wignjosoebroto, 2000).

The classroom is one of the important rooms that must exist in an educational institution, because the lecture room is useful as a teaching and learning tool. Means of supporting the process of learning that is needed in the room lectures include chairs, tables, ironing board, and LCD projector (Ristekdikti, 2019). Lecture halls are ergonomically certainly will make a person feel comfortable in doing activities in that space. However, until now, ergonomics rules have not

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been widely applied in designing lecture halls with their supporting devices. Space lectures were originally only include board board and chalk to write the material in line with advances in technology that there is now space tuition is already equipped with equipment advanced in which the teacher can use a laptop connected to an LCD projector to display the material that will be taught. Will but increasingly sophisticated equipment used humans, not demanding the possibility to be more and much too kind of potential danger ditimbulkanseperti radias of the LCD are in the reflected to a projector screen that can cause eye hot and tired.

The results of the initial observations that have been carried out show that there are still educational staff and educators who currently do not know and understand the ergonomics principles of facilities and infrastructure, but school facilities and infrastructure are in accordance with the standards determined by the relevant Education Office. Through this paper, teachers are required to know about ergonomics theory for classroom facilities and infrastructure, then can apply it to learning so that learning can run effectively and efficiently.

Materials and Methods

This descriptive research refers to several relevant literatures. In this case, it is discussed about ergonomics rules that need to be understood by a teacher as a knowledge that will be applied in learning. This literature review is more focused on efforts to explore relevant, effective and efficient knowledge to be applied in schools and other learning places. The method used is a literature review obtained through various sources.

Results and Discussion

Ergonomics comes from the Greek words *ergon* (work) and *nomos* (rules). Ergonomics is the science, technology, and art of adapting tools, working methods, and the environment to human capabilities, abilities and limitations so that a healthy, safe, comfortable and efficient working situation and condition is obtained in order to achieve the highest productivity (Manuba 1996/2003).

Ergonomics is a multi or interdisciplinary approach that seeks to link tools, methods and work environment to human capabilities, abilities and limitations to provide healthy, safe, comfortable and efficient working conditions in order to increase productivity and welfare of the workforce. Regarding this, all disciplines that talk about humans in their activities, whether they are resting, doing recreation, exercising, even when doing work, will contribute to ergonomics. Tarwaka in Milyani also explained that ergonomics is a science to balance all facilities used both in activities and not with human abilities and limitations physically and mentally so that the quality of life is better (Imtihan Anom et al, 2020).

Looking at the definition above, it is found that ergonomics will be found in every workplace, especially humans who must be in it (Sutalaksana, 2000). Likewise, in designing any work equipment from toothpicks to spacecraft, it is clear that an ergonomic approach is needed to make it pleasing to the eye, comfortable to wear, efficient in use, easy to operate, easy to maintain, inexpensive to finance, and poses little risk, with the hope of improving welfare. workforce (Sutjana, 2015). With the knowledge of ergonomics, a work environment will create a sense of comfort so that it provides comfort and is useful as a prevention medium for work fatigue or work accidents as early as possible before it is fatal.

Utilization of ergonomic principles in designing a product makes it more suitable for the user, satisfying, comfortable and safe (Velesco, 2002) but currently ergonomics principles have not been applied optimally in designing study rooms with supporting devices. For example, the placement of the blackboard, the use of lighting, the size of the seat, the study table and others. (sutajaya, 2013) Factors in the learning environment must be based on ergonomic principles as follows: (1) room temperature is between 24 to 28 degrees Celsius, (2) relative humidity is sought between 70 to 80%, (3) air circulation is close to 0, 2 meters per second,

(4) Cross ventilation is optimally utilized so that it can affect the comfort ofthe study room.

In order to achieve this, it is necessary to apply ergonomic principles in designing learning facilities including: (1) Slowing down the emergence of fatigue, because the energy used can be focused only on learning activities and not wasted (2) Reducing skeletal muscle complaints (3) Avoid eye fatigue (4) Avoid the emergence of boredom while studying.

The seat used when studying needs to be adjusted to the anthropometric (body size) of the person wearing it in order to create a sense of comfort. In this case, in Indonesia, adjust the normal body size. However, if these measurements do not exist, anthropometric measurements can be made of students who use them, but if the data is also not available, the following seating requirements can be used: (1) Footwear height from the floor 38 to 54 cm (2) Sitting mats made slightly tilted back 14 to 24 Celsius from the horizontal plane or floor (3) The front edge of the seat mat is made very rounded to avoid pressure on the bottom of the thigh. The front end can be raised 4 to 6 degrees from the seat. (4) The area of the seat is adjusted to the size of the buttocks, namely 40 to 45 cm transversely and 38 to 42 cm longitudinally (5) Waist and backrests are slightly tilted back at an angle of 105 to 105 110 degrees Celsius against the seat mat.

Study table Is a table that is used as a base when doing learning activities. If the study table is too high, the shoulders will be raised more often when writing or putting hands on the table and if it is too low, the posture will be bent when writing.

To overcome this, it is necessary to choose a study table that suits the wearer. Grandjen recommended that the table height for writing and reading in a sitting position be between 74 to 78 cm for men and between 70 and 74 cm for women. Meanwhile, Dul and Weerdmester revealed that for activities that often use the eyes, hands, and arms, the work area should be at 0 to 15 cm above the elbow height.

Ergonomics rules that can be used as a basis in placing a whiteboard or LCD, Grandjen recommends that eye rotation when viewing objects is no more than 5 degrees above the horizontal plane and 30 degrees below the horizontal plane.

Conclusion

Based on the explanation that has been explained that in carrying out work activities, it is necessary to have a comfortable and quiet place, so to help focus on carrying out this, it is necessary to make the atmosphere and situation of the workplace comfortable. one of them is knowing and understanding argonomy which is a science to balance tools, methods and work environment to be safe, comfortable, and avoid accidents in doing work.

In the world of education, ergonomics is used in the teaching and learning process both internally and externally in the learning process. internal in this case on the tools or means in the teaching and learning process itself such as tables, chairs, computers and others. while external is on walls, roofs, floors and others that can be adequate and support the learning process to run more effectively and efficiently.

In addition, by applying ergonomics in the world of education, it can minimize human resources easily tired in dealing with students because it will affect the interaction between educators, students, and other spheres so that it produces safe, comfortable results and creates a sense of safety in the teaching and learning process.

An organization or agency consists of a group of people who every day perform various work activities, to completethe work that is the main task and function of each worker, of course the agency provides various work support facilities that are expected to assist workers in carrying out their duties. Regarding work facilities, in this case in the world of education, include equipment that is directly related to educators, students and education staff such as tables, chairs, blackboards, a set of computers and even buildings and other supporting facilities. With the availability of these facilities, it is hoped that human resources in working can complete their work or duties properly.

But besides that, the provision of complete and modern work facilities does not guarantee the achievement of productivity, if the existing human resources (workers) are not able to maximize various work facilities properly and correctly, causing the facilities to be damaged, not comfortable and dangerous and even not used.

In addition, the simplest impact occurs in carrying out activities, namely fatigue. Symptoms of fatigue are feeling tired, decreased alertness, slow perception, in addition to decreased physical and mental work. Fatigue is classified into two types, namely muscle fatigue caused by tremors in the muscles (feeling pain) and general fatigue usually characterized by reduced willingness to work due to monotony, intensity, duration of physical work, environmental conditions, mental causes, health status and nutritional status (Grendjen, 1993).

Byrd and More said the decline in work productivity in workers was mainly due to work fatigue. The ILO in 1983 revealed that the factors that influence the occurrence of work fatigue are the monotony of work, the intensity and duration of work and unprofessional physique, work environment factors, weather and noise, illness and inadequate nutrition (Torik Husain, 2009).

Judging from the description above, it can be seen that the fatigue factor can also be one of the factors that make workers ineffective which is then encouraged by less ergonomic agencies, forced attitudes and less or even inappropriate timing, on tools and work facilities that are not in accordance with the anthropometry of the wearer. Anthropometry is very important in ergonomics because it is related to the measurement of the dimensions of the human body, which can be widely used as a consideration for designing workplaces that are involved with humans.

But in reality and based on observations made there are still many schools that have not implemented ergonomics theory, this is one of the reasons for the lack of knowledge of human resources in the education sector. Based on the explanation above, knowing and understanding ergonomics for educators or human resources in an educational institution is very important in order to improve security, comfort, safety in the teaching and learning process so that the expected quality of education is achieved.

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