



The Relationship Between Table and Chair Size and Ergonomics Studies in Elementary Schools

Ilmar Cahyo Prayoga; Kasiyan

Faculty of Language, Art, Culture, Yogyakarta State University, Indonesia

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Abstract

Ergonomics is a science that discusses the harmony of all forms of equipment when carrying out activities and in a state of rest with individual abilities and limitations, both physically and mentally, which is expected to be able to provide a better quality of life in a complex manner. This study examines the relationship between table and chair sizes ergonomically and anthropometric measurements in elementary schools. The goal was to find out the relationship between table and chair size ergonomically and anthropometric measurements affecting the comfort and health of students. at State Elementary School 11 Bathin Solapan, Bengkalis Regency, Riau Province. By using a descriptive qualitative approach, which is literature research. The findings of this study show that the facilities of the 11 Bathin Solapan State Elementary School. The results of this study show that the table and chair facilities at the 11 Bathin Solapan State Elementary School have not met ergonomic standards and anthropometric measurement standards, this causes uncomfortable posture and has the potential for health problems in students. These findings emphasize the importance of applying ergonomic principles in the design of table and chair facilities to support students' health and learning achievement. The importance of improving the design of tables and chairs to be in accordance with the concept of ergonomics and anthropometry, so that it can improve comfort, health, and effectiveness in the learning process at school

Keywords: *Ergonomics; Art; Anthropometry*

Introduction

Indonesia is a developed and developing country, including in its educational aspects. Education is the main thing for every individual for the sustainability of their future. According to (Hidayat et al., n.d.), education is a conscious effort given by adults to provide guidance and support in developing their potential both physically and spiritually to students to achieve maturity in achieving goals in order to be able to carry out their life duties in a directed manner. The educational environment is a complex part for students in carrying out the learning process (Saputra et al., 2021). Environmental comfort in the learning process can be one of the supporting factors for the achievement of students' learning outcomes during learning activities (Susanti & Aulia, 2016). Therefore, education is a place where students learn to explore their potential supported by a comfortable environment and space in the learning process.

The learning space provided in learning activities needs to be designed and designed by paying attention to the environmental comfort factor as part of the ergonomic aspect. One of the ergonomic aspects in the student's learning room in creating student learning comfort is the school's facilities. Humans need facilities that support their activities so that they can facilitate their activities. Facilities that are often used by students in learning activities are tables and chairs.

In Indonesia, the problem of incompatibility from the perspective of ergonomics between humans and their facilities and their effect on comfort has not received serious attention from the government. The comfort of the teaching and learning process for students is influenced by several factors, one of which is the factor of the facilities used at school (Makomulamin et al., 2023). Therefore, the suitability of the design of chairs and tables in the learning process can affect the comfort and quality of learning at school.

According to (I Made Sutajaya, 2016); (Mahawati et al., 2021), ergonomics is a science, art, and technology in harmonizing various facilities used in activities and rest on the basis and limitations of human beings in terms of mental and physical aspects which aims to improve the quality of life for the better. If the tables and chairs used have ergonomic value in them, then physical and psychological health will be maintained in the educational process at school. Therefore, the ergonomics of desks and chairs for students is one of the important roles of comfortable learning and makes learning more quality at school.

School is an environment in the realm of education that is expected to be able to create human beings who have intellectual, emotional, and spiritual thoughts (Nurfirdaus & Sutisna, 2021). Schools are the ones that provide facilities in learning activities to students (Mahira, 2019). Therefore, school is a place where a person creates intelligence from various aspects ranging from intellectual, emotional, and spiritual with supporting materials for existing suggestions to support learning. Students/students usually study in school every day spending 5 to 8 hours per day. The learning process at school which spends about 30% of the time at school, this is done by students starting with activities that are carried out ranging from writing, reading, and creating so that students will sit and do activities for a long time. One of the supports in the learning process that is a means of learning for students is chairs and study tables. In this process, ergonomics from various points of view is very necessary and must be considered in educational institutions so that the existence of chairs and study tables is one of the means of aids in the learning process. Classroom ergonomics is an important factor in producing the expected teaching and learning process in accordance with learning objectives (Herwanto et al., 2018).

Facilities in the form of tables and chairs designed using ergonomic studies and anthropometric measurements, especially for students in elementary schools, provide a learning effect with the level of ergonomics and anthropometry in students. The incompatibility between table and chair facilities that do not have ergonomic elements is an obstacle that has an impact on low-quality human resources (Dimensi et al., 2012). The ergonomic approach to the learning process aligns the student's workload and capacity (abilities, abilities, limitations), in this context students absorb knowledge in school to be more effective, safe, comfortable, and healthy to acquire knowledge to the maximum (Azizah & Isnaini, 2023). Thus, ergonomic factors in learning facilities indirectly support the health and learning outcomes of students in the world of education.

So far, only a few have discussed the theory of ergonomics of facilities in educational institutions. This is the reason why it is necessary to study the ergonomics of learning facilities (tables and chairs) that are less ergonomic which is one of the causes of students' discomfort in following the learning process in elementary schools. This is the basis for the need to pay attention to ergonomic learning facilities and anthropometric measurements in elementary schools. Therefore, a lot of research is needed on the relationship between the size of ergonomic tables and chairs and the comfort of elementary school students' sitting positions.

Based on the description above, this study is formulated in several questions as follows; 1) How do tables and chairs affect ergonomics studies on comfort in elementary schools?; 2) Suitability of ergonomics and anthropometric measurements of facilities in elementary schools?

Research Methods

This study examines library *research*, which is an activity where this literature research is often also called literature research, where this data is collected, recorded, read and processed which is included in the archives of the library without the need for direct research (Zed, 2008). This study uses a descriptive qualitative approach in looking for more in the necessary study. The data collection technique is carried out by searching and identifying relevant literature such as books and journals to be reviewed, This study examines the influence of tables and chairs on ergonomic studies and their impact on elementary school students. This qualitative approach provides a broad insight into the ergonomics of table and chair facilities and uses in-depth and meaningful analysis methods. This approach provides a comprehensive view of the study of ergonomics that affects various domains including the realm of art, education, and health by the production and dissemination of data in the context of research.

Discussion and Results

1.Ergonomic Value of Classroom Facilities

The expression ergonomics in Latin has the basic meaning of "*ergon*" which means work and "*nomos*" which means natural law, it is concluded that the meaning of ergonomics is as a science that studies the human dimension and the work environment (Fajar Baichuni, 2019); (Widagdo, 2019). In ergonomic science, it discusses how humans and facilities work with humans. Widiastuti in (Azizah & Isnaini, 2023). Ergonomics is the science, art and technology in harmonizing all forms of equipment when carrying out activities and in a state of rest with a person's abilities and limitations both physically and mentally which are expected to be able to provide a better quality of life in a complex manner.

Ergonomics has several aspects, one of which is the art aspect. The art applied in the study of ergonomics produces works that are feasible both conceptually and functionally. Ergonomics is also part of designing a facility by applying complex viewpoints to its application. A work designed using the concept of ergonomics creates a quality work. Ergonomics plays an important role in creating works of art that are feasible and have functional value (Setiadi & Kusuma Tatwa, 2023). Therefore. Ergonomics in designing and creating artworks need to be considered to create works that not only have quality but also have feasibility and functional values in it.

Ergonomics is a science, this certainly affects concentration and comfort in learning received by students. One of the causes is the lack of understanding of ergonomic principles in schools related to existing facilities and infrastructure. Factors that support the development of students here are the quality of teachers, learning programs, and the surrounding environment. The surrounding environment is a place for students to learn, a means of education, and understanding. To obtain good educational and learning activities, a complete learning scope plays an important role in supporting educational and teaching activities in educational institutions (Sudibyo & Nugroho, 2020).

One of the facilities that is a means of learning for students is chairs and tables, these facilities should have ergonomic value. Ergonomic desks and chairs can provide comfort, safety, and health to students. On the other hand, if ergonomics is not considered too important in educational institutions, it can cause various adverse impacts, this occurs significantly both in a relatively short period of time and in a long period of time. Research on the relationship between chairs and ergonomic desks in elementary

school students is still little studied. It is considered that there are no special rules that determine the relationship between facilities (chairs and tables) with comfort and their impact on health and learning. Anthropometry of students is something that needs to be considered, especially for the community. When designing ergonomic chairs and tables in educational institutions to avoid future health problems such as spinal diseases (Desmyanti et al., 2021).

Some school facilities need to meet the ergonomic rules of students can hinder students in the teaching and learning process (Mahira, 2019). The design of facilities to support the learning process such as chairs, tables, which are not in accordance with ergonomic principles is also often encountered, causing students to have an awkward posture during learning. This causes students to feel uncomfortable in the process of absorbing knowledge during teaching and learning.

In the problem of the 11 Bathin Solapan State Elementary School, Bengkalis Regency, facilities are a problem that occurs where the suitability of ergonomic concepts in the realm of education provided is still not paid attention to by educational institutions. The size of the facilities in the form of tables and chairs provided varies not according to their height, weight, and posture, so that students sit in a bent state during the teaching and learning process. This also has an impact on health and anthropometry on the body health of elementary school students. The mistake that occurred in students was the mismatch of the ergonomics of the tables and chairs where students in elementary school sat and studied with tables and chairs that were not suitable in an anthropometric view.

Ergonomics talks about the adjustment between design and humans, according to Annis & McConville (1996) and Manuaba (1999) in (Kurniawan et al., 2018). They said that ergonomics is information related to human abilities, characteristics, and limitations in designing jobs, workspaces, and environments efficiently, healthily, comfortably, and safely for humans for their lives.

According to (Wahyudin et al., 2020), ergonomics in general has principles in it, including the following:

1. Utility is said to be a product that is created to have benefits in supporting a job and its needs as a whole.
2. Safety; all goods produced have value and usefulness that have benefits for the wearer.
3. *Comfortability*; the goods produced have a purposeful purpose that does not interfere with the work of its use
4. Flexibility, can be a benefit for the interests and needs in every existing condition and situation.
5. Durability; is an item that will be durable and has a level of durability so that it is not easily damaged if used.

In its development, ergonomic studies are divided into various fields, namely: (Idkhan & al, 2021).

1. The study of display: A device that provides and provides information to people
2. Study of human physical strength: is a study with observation and research on the endurance of the human body when doing work, including the design of an object and equipment used in accordance with the context of human physical ability.
3. Workplace size study: a study that aims to produce a workspace design that suits the posture of the user.
4. Study the work environment: observe and research the surrounding conditions of the workspace along with facilities, noise, and temperature regulation.

As for this study, the researcher intends to examine the theory of ergonomics in facilities in the realm of educational institutions, especially at the 11 Bathin Solapan State Elementary School as a measure of education with its environment. This provides a conceptual overview of the relationship between desks and chairs using ergonomic studies on the comfort of sitting positions in the teaching and learning process in the classroom to create a comfortable and safe learning environment.

2. Ergonomics and Anthropometric Measurement of Facilities in Elementary Schools

In fulfilling the ergonomic aspect, tables and chairs have many benefits as facilities in the realm of education. According to Kroemer (Putri, 2014) are: (1) a comfortable environment has the impact of no burden; (2) good appearance (design) creates a good impression on the user; (3) has a backrest or cushion and space at the waist; (4) create a sense of comfort and security; (5) providing relief values in the form of health, satisfaction, and happiness to those who use it; (5) The user feels relaxed when doing something, especially when doing work.

In the process of teaching and learning activities involving writing, reading, painting, and creativity. In the concept of learning, students learn and receive old lessons continuously. The long learning process without considering the facilities that ergonomics has an impact on the body becomes uncomfortable. Therefore, the importance of comfort during learning at school is related to the facilities provided by the institution. Chairs and tables are facilities designed in accordance with ergonomic concepts capable of maintaining in various contexts, especially human health and development. This is expected to increase comfort when carrying out learning activities at school and increase students' motivation to learn. Ergonomic suitability in learning facilities also applies the concept of anthropometric measurement.

The term anthropometry is divided into the word *anthro* and the word *diametry* which means human and size (Devinasari et al., 2019); (Fitri, 2018); (Santosa, 2016). By definition, anthropometry can be said to be a special science that is sourced from the measurement of the human body (Devinasari et al., 2019); (Santosa, 2016). Anthropometry talks about the characteristics of the human body, ranging from shape, size, and even strength connected in a component of Numianto's numerical data (Suhartini, 2020). Therefore, anthropometry talks about measurements that discuss humans in terms of numerical data components by including their size, shape, and strength. The application of this data is then used to deal with problems related to the design of school facilities to create a design that is in accordance with anthropometry and ergonomics.

The relationship of anthropometry to child growth needs to be considered. The growth period of children to adults needs to be considered, especially in the realm of school. The school as an educational institution that teaches students to gain knowledge starting from the PAUD level to the lecture level. As long as humans live, they will continue to learn. This is the essence of every human being in life. This anthropometric measurement is closely related to the growth of a person who needs to be considered in all educational institutions. School is an educational institution where a person gains knowledge and growth, especially in elementary school.

Elementary school is an early school institution after PAUD/Kindergarten where students learn continuously intensively. In elementary school, students study at least 5 to 8 hours per day, which means about 30% of their daily activities. Students who study at school in their growth often experience complaints during the learning process. Complaints that often occur during the growth period of elementary school range from 7 to 12 years old. One of the impacts caused is complaints on the spine due to the lack of facilities that are not suitable for ergonomics and anthropometric measurements. Almost every school in Indonesia does not pay attention to the impact caused by the incompatibility of facilities in its educational institutions, one of the 11 Bathin Solapan State Elementary Schools is one of the schools that has the same impact on students who use existing facilities.

At the 11 Bathin Solapan State Elementary School, many students use facilities that are far from the concept of ergonomics. Desks and chairs used in studying are often a problem. With various sizes ranging from high tables and low chairs, the height of chairs and study tables, the size of tables and chairs, and the width of tables and chairs at the 11 Bathin Solapan State Elementary School, the use of tables and chairs that are harmonious causes learning to feel uncomfortable and lack of focus in the learning process. Long learning time often makes elementary school students unfocused in their learning process. This needs to be considered by educational institutions, because the posture of elementary school (SD), junior high, high school/vocational school children is different at each level. In the teaching and learning process, students will feel more comfortable with facilities and facilities that are in accordance with the rules of ergonomics and apply the elements of anthropometric measurement.

Studying in elementary school is usually carried out in an educational institution for 6 years. Where at this time students are more focused on learning and playing. Studying in school also helps students in understanding the actual educational context. If students learn comfortably and safely, it will be easier for them to absorb and accept the learning carried out at school, this is related to learning and comfort. If the facilities used are comfortable, students are more happy to receive learning and can maintain the health and growth of students while at school, especially at the elementary school level. Comfort when students are in the learning process at school, of course, often involves facilities such as desks and chairs from existing educational institutions. Desk and chair facilities that are often used in learning activities in educational institutions, especially elementary schools.

Comfort in the learning process involves facilities in the form of tables and chairs, so the size must be in accordance with anthropometry for the user. The cool thing is, the use of chairs must be ergonomic during the teaching and learning process. However, if the anthropometry of students is in learning, the main requirements for the right seat/chair and can be used are as follows: (Sutanjaya, 2016)

1. Seat height from 38 cm to 54 cm (height from the sole of the foot to behind the knee)
2. It is better that the seat cushions are tilted slightly towards the back (with an angle of 14° - 24° focusing on the plane of a straight line horizontally or the floor section). Aiming for the posture of the body part to point forward or fall while sitting, this tilt is very important and necessary.
3. The front of the chair is given a slightly made or oval cushion in order to ensure that the lower part, precisely on the chisel, does not experience pressure. This front end can be raised by 40-60 of the seat cushion section.
4. The area of the back size is adjusted to the size of the buttocks, namely: width ranges from 40-45 cm and length 38-42 cm.
5. The waist and back are tilted 105° - 110° to the seat cushion. The design of the backrest and waist is adjusted to the curvature of the spine on the human body. The backrest is intended as a support and the back or waist feels comfortable with a height of 4 cm to 50 cm and a width of 32 cm to 36 cm.

By implementing seating facilities and study chairs at predetermined standards, students become more comfortable and safe in carrying out activities during learning at school, especially at the 11 Bathin Solapan State Elementary School.

The study desk is one of the school facilities used in educational institutions during learning activities. If the study desk is not suitable for students/students with the concept of anthropometry where the size of the study table is low students will bend and the table that has a high size of legs will make students force themselves to lift their shoulders and hands during the learning process of learning and writing and the importance of paying attention to the learning process carried out (Sutanjaya, 2016).

Therefore, the importance of attention by educational institutions is highly expected in designing and designing school facilities, especially tables and chairs that apply the concepts of ergonomics and anthropometry to elementary school children. In elementary schools in Indonesia, especially at 11 Bathin Solapan Elementary School, Bengkalis Regency, Riau Province, this is very rarely noticed by educational institutions. Sekolah Menengah Negeri 11 Bathin Solapan still has many who use desks that are still far from complex ergonomically and anthropometrically, the desks and chairs used are classified as makeshift without considering the growth, comfort, and maturity of students in elementary school, so that students often feel less focused when accepting existing learning, if the tables and chairs used without applying the functional concept and the benefits of these tables and chairs have an impact to students/learners who continue to feel tired and uncomfortable when using it provided by elementary schools.

Student fatigue when using the desk has an impact on their posture. This happens gradually starting from time to time without realizing it. Fatigue is a condition where progress decreases which is characterized by a body that feels uncomfortable so that it affects the results of performance in doing work (Mutmainah & Sari, 2018), the cause is because the desk used for the writing and reading process is very low so that students tend to squat. Fatigue is not only felt in the body but also in the neck and back. The position of the hands that are not aligned with the position when learning also affects and causes fatigue in students (Yusuf et al., n.d.). According to Cross in (Miftah & Lamasitudju, 2022), there are three aspects that cause students to feel bored in learning activities, including physical fatigue, sensory fatigue, and sensory fatigue. This impact that often occurs on elementary school children starts with them learning, writing, drawing, playing, and creating, students who spend learning activities at school feel that they feel tired when receiving learning from teachers.

Students need well-designed ergonomically designed table and chair facilities and apply anthropometric measurements in the means they use. Because if the desks and chairs are not designed properly, students/students will be trapped with posture and body positions that bend over when carrying out learning process activities and activities in the classroom ranging from writing, reading, drawing, and other activities (Taifa & Desai, 2017). Therefore, it is necessary to study ergonomics in designing and designing tables and chairs to produce facilities that are in accordance with anthropometric measurements.

Ergonomic table and chair design is using anthropometric measurements to produce and create appropriate, comfortable, and safe table and chair facilities for its users. By fulfilling the rules of ergonomics, users can maximize the benefits obtained, such as a sense of comfort when using it. The design of tables and chairs is designed using the concept of ergonomics and anthropometric measurements to create a craft of art that not only has aesthetic value but also has functional value in the design of these tables and chairs.

Meanwhile, in making a study desk, it is better to apply an ergonomic study to the study desk which consists of the height, length, and width of the study table. According to (Irvan et al., 2017) an ergonomically designed table includes the following conditions: (1) The height of the table size, in determining the height of the table, apply the size of the 50th percentile value as a measure of the height of the sitting elbow, because if the size of the table is high, the elbow can be raised when doing activities such as writing and studying at school; (2) The length of the desk, in determining the table with long dimensions, you can use the width of the fingertip that extends from the left to the right, the appropriate size on the length of the study desk uses the 95th percentile; (3) In determining the size of the width of the table, apply the dimension of hand length or the reach of the hand from the shoulder to the fingertips, this measure uses the 95th percentile in measuring the width of the table.

The influence of tables and chairs on the learning comfort of students in elementary school using ergonomic studies and anthropometric measurements can be said that elementary school students/students

can increase the focus, comfort, and safety of students in receiving learning. Through design and design by applying the concepts of ergonomics and anthropometry as well as the role of art in creating crafts that are in accordance with the standard requirements that guide in creating chairs and tables with ergonomics. Ergonomics in facilities creates conducive learning, participants are more comfortable when ergonomics are considered and its application to various existing facilities. The impact of this understanding creates harmony in every learning in schools, especially elementary schools. With appropriate facilities, students can also indirectly improve learning outcomes and related to it more easily understand and accept learning. According to (Prianto & Putri, 2017) adequate learning facilities will create learning motivation and learning outcomes in students can be improved better.

Conclusion and Suggestions

Based on the results of the study, the principle of ergonomics was used in the facilities of tables and chairs at the State Elementary School 11 Bathin Solapan in Riau province. Based on the formulation of the problem and the results of the discussion above, the first conclusion is that the ergonomics study affects the comfort of students and their concentration in the teaching and learning process. Universally, the discussion of this ergonomics study is divided into several elements: ergonomic value, classroom facilities, ergonomic suitability and anthropometric measurements. Elementary school students need well-designed facilities and infrastructure by applying ergonomic principles. The application of ergonomics to the table and chair results in comfort and safety when used in the learning process. And it is necessary to pay attention to several factors that affect it. Second, the appropriateness of ergonomics studies and anthropometric measurements should be more viewed at every level of education in Indonesia. The role of facilities in schools, especially tables and chairs whose ergonomics and anthropometric measurements need to be applied in the world of education, with the suitability of the context of ergonomics and anthropometric measurements can have an impact on the health and development of students, especially in elementary schools. Thus, the suitability in the context of this facility does not only affect all aspects ranging from health, learning, comfort, and safety. By applying principles that are in accordance with the rules of ergonomics and measurement, anthropometry can create a well-coordinated learning space. Therefore, efforts to create healthy and impactful learning can begin by paying attention to school facilities, especially tables and chairs that are ergonomic and anthropometric measurements. In this way, the importance of the concept of ergonomics and anthropometric measurements in school facilities, especially elementary schools, and its application to table and chair facilities that are in accordance with the rules of proper suitability and have functional value in educational institutions as an effort to improve health and comfort in the teaching and learning process at school. Ergonomic desks and chairs are also one of the factors in achieving learning outcomes and healthy growth development for students in Indonesia, especially in elementary schools.

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