

A Case Study of the Design Issues of Classroom Chairs in Visual Arts Education Classrooms in Malaysian Schools

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ABSTRACT

Classroom chairs are considered a very important primary need for students to improve comfort and concentration in the learning environment. The aim of this study is to review the suitability chair for visual art classroom with using an ergonomic approach in secondary school in Hulu Langat, Selangor, Malaysia. Chair design that has ergonomic features including comfort and safety to use. Therefore, ergonomic chairs are considered very important for usability and comfort for students. Ergonomic chairs ensure better comfort and confidence for students in the classroom environment. The objective of this research study is first to reveal the ergonomic problem of musculoskeletal disorders and the second objective is to solve the problem of musculoskeletal disorders in the visual arts classroom. The method proposed in this chair design study is based on data that has been collected from students through pilot data and a final study using questionnaires and IBMSPSS statistics. The study chair for the proposed art education class has been tested and confirmed and refined based on a total of 250 student feedback from the visual art education class after using it. This research study concludes with a review of limitations and future research directions.

Keywords: Ergonomic chairs, ergonomic, musculoskeletal disorders visual arts education classes, survey data, chair comfort.

INTRODUCTION

Visual Arts Education is an essential component of the Malaysian primary and secondary school curriculum, aiming to develop students' creativity, innovation, and critical thinking skills. Unlike conventional classrooms, lessons involve a wide range of practical activities, including drawing, painting, printing, sculpting, and craftwork, which require students to maintain various sitting postures and perform repetitive upper-body movements for extended periods. Consequently, classroom furniture should provide adequate ergonomic support to ensure students' comfort, safety, and learning effectiveness (*Kementerian Pendidikan Malaysia, (2018)*).

Despite these unique learning requirements, most Malaysian schools continue to use standard classroom chairs that are designed for general academic lessons rather than art-based activities. These chairs rarely consider ergonomic factors such as students' anthropometric characteristics, back support, seat dimensions, or prolonged sitting duration. As a result, students frequently experience discomfort, fatigue, poor posture, and reduced concentration during Visual Arts lessons (Al-Hinai et al., 2018).

Previous studies have consistently reported that classroom chairs that do not match students' body dimensions increase the risk of musculoskeletal disorders (MSDs). Poor compatibility between chair dimensions and students' anthropometric measurements contributes to neck, shoulder, and back discomfort while negatively affecting posture and classroom performance (Ahmad et al., 2024). Similarly, Afrifah and Glalah (2025) demonstrated that mismatched classroom furniture significantly increases muscle strain, postural problems, and long-term musculoskeletal discomfort among students.

Although numerous ergonomic studies have investigated classroom furniture, limited attention has been given to chairs specifically designed for Visual Arts Education classrooms in Malaysia. Existing research mainly focuses on general classroom environments, with little consideration of the unique physical demands of art-based learning activities. This gap highlights the need to evaluate existing classroom chairs and propose an ergonomic design based on students' anthropometric characteristics and ergonomic principles.

Therefore, this study aims to analyse the ergonomic limitations of existing chairs used in Malaysian Visual Arts Education classrooms and examine their relationship with students' musculoskeletal discomfort. Based on these findings, the study proposes an ergonomic chair design framework that integrates anthropometric measurements and ergonomic principles to improve students' comfort, safety, and learning performance during Visual Arts Education activities.

LITERATURE REVIEW

Visual Arts Education Classroom

Visual Arts Education classrooms differ considerably from conventional academic classrooms due to their emphasis on practical, studio-based learning activities. Students are actively engaged in drawing, painting, sculpture, printmaking, and mixed-media projects that require continuous interaction with art materials and equipment. These activities involve repetitive upper limb movements, frequent changes in body posture, prolonged sitting, and occasional standing, all of which place different physical demands on students compared to traditional classroom learning. Consequently, the physical learning environment, particularly classroom furniture, plays a crucial role in supporting students' comfort, safety, and learning performance.

Visual Arts Education plays a vital role in students' holistic development, particularly at the primary school level. It provides opportunities for learners to enhance their academic abilities, creativity, critical thinking, and self-expression from an early age. The experiences gained through arts education contribute significantly to students' future learning and personal development.

According to Paul T. Sowden, Professor of Psychology at the University of Winchester, arts and humanities education has received less emphasis in countries such as the United Kingdom and the United States due to the increasing focus on science and technology. However, arts education remains essential as it helps students develop resilience, perseverance, communication skills, self-confidence, and cognitive abilities. Therefore, Visual Arts Education should be accessible to all students because it supports both educational achievement and everyday life skills (Conway D, 2019).

Furthermore, Visual Arts Education, which is offered at both primary and secondary schools, has been carefully designed in accordance with the objectives of the National Philosophy of Education (NPE) and the current developments in the education system. Plays an important role and makes a significant contribution to the overall development of students at both primary and secondary levels. Therefore, effective teaching and learning of are essential in supporting the teaching and learning process in classrooms or art studios. In this regard, teachers play a key role in determining students' creative outcomes.

Visual Arts Education is a subject that has a positive impact on all students when it is implemented in a well-planned and effective manner. It also helps students reduce the stress they experience while learning other academic subjects (Aizat & Hassan, 2018).

Ergonomics

A common problem in classrooms is the lack of ergonomically designed chairs, which results in abnormal or inappropriate sitting postures. This condition contributes to increased physical strain, back pain, muscle pain, neck pain, and headaches, as well as reduced concentration and restlessness as students attempt to find a more comfortable sitting position (Andrew M. Briggs & Anthony D. Woolf, 2018).

The most significant ergonomic risk factors identified are awkward postures while performing work tasks, force exertion, repetitive movements, and exposure to vibration. Other ergonomic risk factors include prolonged uncomfortable static postures, contact stress on muscles and tendons, and exposure to extreme temperatures. These ergonomic risk factors are considered early warning signs of increasingly serious problems, as they manifest through physical signs and symptoms that may lead to severe injuries. Long-term exposure to these risk factors can reduce an individual's quality of life. The risk of injury increases when work requires a person to perform tasks with body segments positioned outside their neutral range of motion, resulting in awkward postures (Anagha R., 2020).

Ergonomic Chair

Ergonomic chairs are important for Visual Arts Education classes in secondary schools because they provide comfort and support students during long periods of sitting while completing art projects. These chairs help maintain proper posture, reduce the risk of back pain and injuries, improve concentration, increase productivity, and promote overall health and well-being. Therefore, ergonomic chairs are essential in supporting a comfortable and effective learning environment for Visual Arts Education students (Ansari et al., 2018).

Ergonomic chairs used in classroom environments should help improve students' attention and motivation during learning sessions. However, if the chair design is unstable or inadequate, it may cause problems related to students' body structures, such as ligaments, joints, and the spine (Andrew M. Briggs & Anthony D. Woolf, 2018).

Seat designs that are excessively deep and wide should be avoided. Instead, greater attention should be given to the backrest and armrests to ensure optimal comfort and support. A study suggests that overly deep seats should be replaced with better-designed backrests. This issue can be addressed by adjusting the backrest forward or adding additional support to the lower back area. This approach can improve comfort levels, enhance posture, reduce pressure on the back and buttocks, and ensure that the feet can rest on the floor without excessive pressure, thereby protecting the body from the risk of injury (Parvez et al., 2019).

Musculoskeletal Disorders

Musculoskeletal Disorders (MSDs) are conditions that affect soft tissues such as muscles, tendons, nerves, joints, cartilage, and ligaments. They are also known as cumulative trauma disorders, repetitive strain injuries, repetitive motion disorders, and overuse syndromes. Most Work-Related Musculoskeletal Disorders (WRMSDs) develop over time and are caused either by the nature of the work itself or by the worker's work environment (Anagha R., 2020).

Several studies have shown that most physical problems in classroom environments are caused by mismatches between students' anthropometric dimensions at different ages and sizes, and are also closely related to incorrect sitting postures. Classroom chairs and desks designed and developed by furniture manufacturers are not suitable for individual students but are instead based on general student anthropometric dimensions. These types of chairs are mostly non-adjustable and unable to meet the needs of students due to variations in their anthropometric dimensions (Andrew M. Briggs & Anthony D. Woolf, 2018).

Previous Studies

Previous studies have consistently highlighted the importance of ergonomic classroom furniture in promoting students' comfort, health, and learning performance. Research conducted by Al-Hinai et al. (2018) demonstrated that classroom furniture designed according to students' anthropometric characteristics significantly improved sitting comfort while reducing musculoskeletal discomfort. Similarly, Ahmad et al. (2024) reported that mismatches between classroom chair dimensions and students' body measurements contributed to poor sitting posture and increased physical discomfort during classroom activities.

More recently, Afrifah and Glalah (2025) found that prolonged use of non-ergonomic classroom chairs increased the prevalence of musculoskeletal symptoms among secondary school students, particularly in the neck, shoulders, and lower back. Other researchers have likewise emphasised that anthropometric compatibility should be considered a fundamental criterion when designing educational furniture to accommodate the physical diversity of students. Collectively, these studies demonstrate that ergonomically appropriate classroom furniture contributes not only to students' physical health but also to improved learning engagement and classroom participation.

Despite these significant contributions, existing studies have primarily focused on general classroom environments rather than the specialised context of Visual Arts Education classrooms. Research examining ergonomic issues specific to art classrooms remains limited, particularly within Malaysian secondary schools. Furthermore, few studies have investigated the relationship between students' body weight and musculoskeletal disorders in relation to classroom chair design. This lack of empirical evidence represents an important research gap that justifies the need for the present study. Accordingly, this research investigates the design problems associated with existing classroom chairs used in Visual Arts Education classrooms and proposes an ergonomic chair design framework that better accommodates students' anthropometric characteristics and learning requirements.

METHODOLOGY

This research works with survey data collected among students in visual arts classroom. The purpose of the survey is to serve as a reference to compare the issues associated with existing classroom chairs and the musculoskeletal problems experienced by students in visual arts education classes. This study was conducted using a quantitative approach through an online survey involving respondents comprising secondary school visual arts education students and teachers. This study is conducted using a quantitative method, specifically through online questionnaires involving respondents consisting of secondary school students and Visual Arts Education teachers. In addition, this chapter will discuss the entire research process for identifying and analysing issues related to chairs used in Visual Arts Education classrooms. Figure 3.0 shows the flowchart of the research methodology conducted.

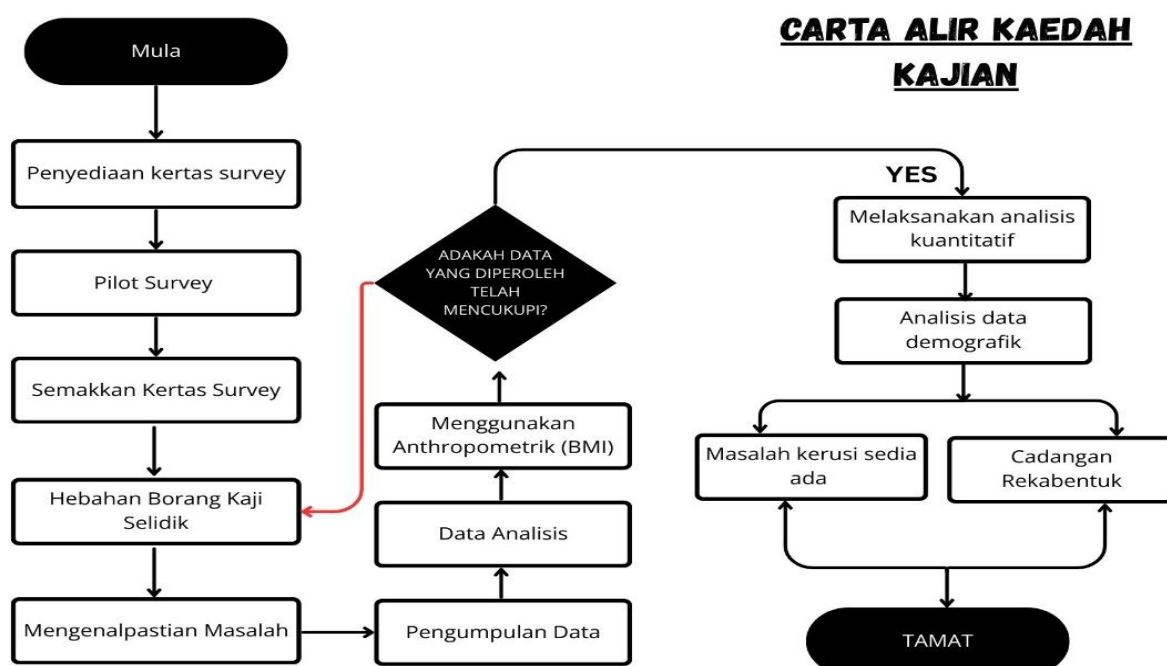


Figure 3.0: Research methodology flowchart

The data collected from this study will serve as a guideline for comparing issues related to existing chairs with musculoskeletal pain problems experienced by students in Visual Arts Education classes. It is important to understand the ergonomics of chair designs in this study so that they are appropriate and aligned with the overall research process. This includes the participation of respondents involved in providing the research data.

Pilot Data

A pilot study was conducted to assess the feasibility and effectiveness of the research instrument before the implementation of the main study. The pilot survey enabled the researcher to evaluate the clarity of questionnaire items, identify potential technical issues during data collection, and determine whether the instrument adequately addressed the research objectives. Feedback obtained from the pilot respondents was used to improve the wording and organisation of the questionnaire where necessary.

The pilot survey involved 20 respondents, while the main study consisted of 250 respondents. The pilot data were analysed separately and were not included in the final statistical analysis. The results indicated that the questionnaire was suitable for the main data collection process and capable of generating reliable information for subsequent statistical analysis.

Data Collection

Data collection was carried out using an online questionnaire distributed through Google Forms. The survey link was forwarded to Visual Arts Education teachers, who subsequently shared it with eligible students in their respective schools. The online approach enabled respondents to complete the questionnaire at their convenience without geographical limitations.

The data period lasted for eight weeks, providing sufficient time for respondents to complete the survey and enabling the researcher to obtain the required sample size. Throughout the data collection process, respondents participated voluntarily, and confidentiality was maintained in accordance with research ethics.

RESULTS AND DISCUSSION

Demographic data

The demographic data of this study describe the basic information of students and teachers involved in Visual Arts Education classes in schools. The basic information obtained from this questionnaire includes the respondents' age, gender, employment status, and body weight. Figure 4.1.1 shows a pie chart classifying the ages of respondents who participated in the survey. This study focuses on students and teachers involved in the teaching and learning process of Visual Arts Education classes. Based on the data obtained, 89% of the recorded respondents were aged 16–17 years, representing upper secondary school students.

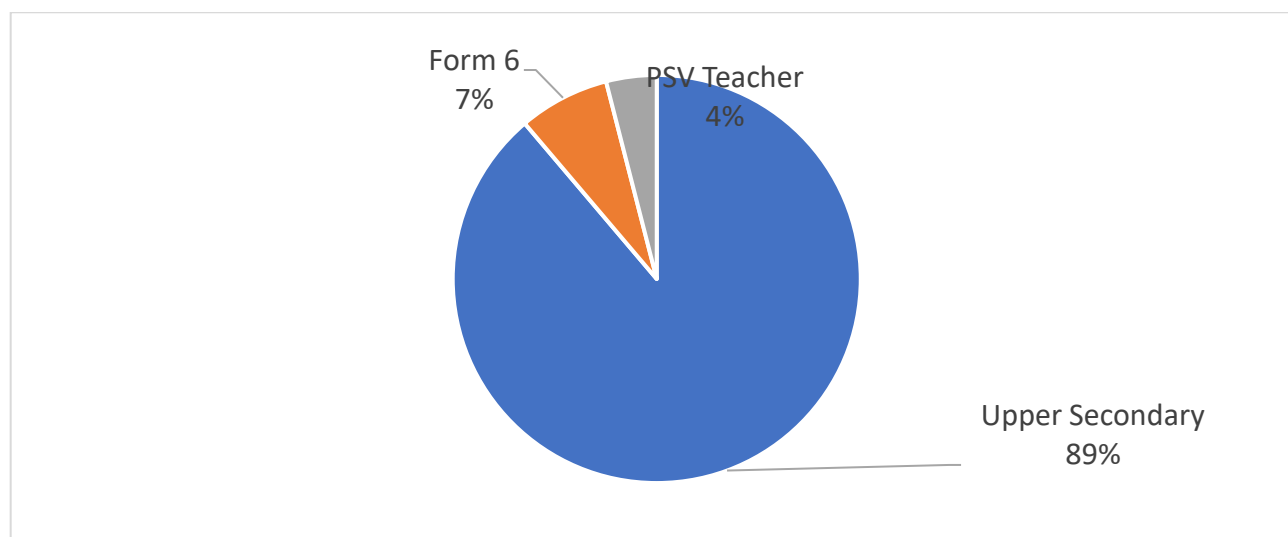


Figure 4.1.1: Age of the respondents

Meanwhile, 18 respondents, equivalent to 7.2%, were in the 18–19 age category and consisted of Form Six students. The demographic data also indicate that 10 respondents, equivalent to 4%, were Visual Arts Education teachers with an age range between 45 and 58 years. Based on this analysis, the number of respondents who were secondary school students was higher, as the researcher’s objective focused on upper secondary students taking the Visual Arts Education subject. Nevertheless, the comfort of teachers and Form Six students who also use the Visual Arts Education classroom facilities was not overlooked.

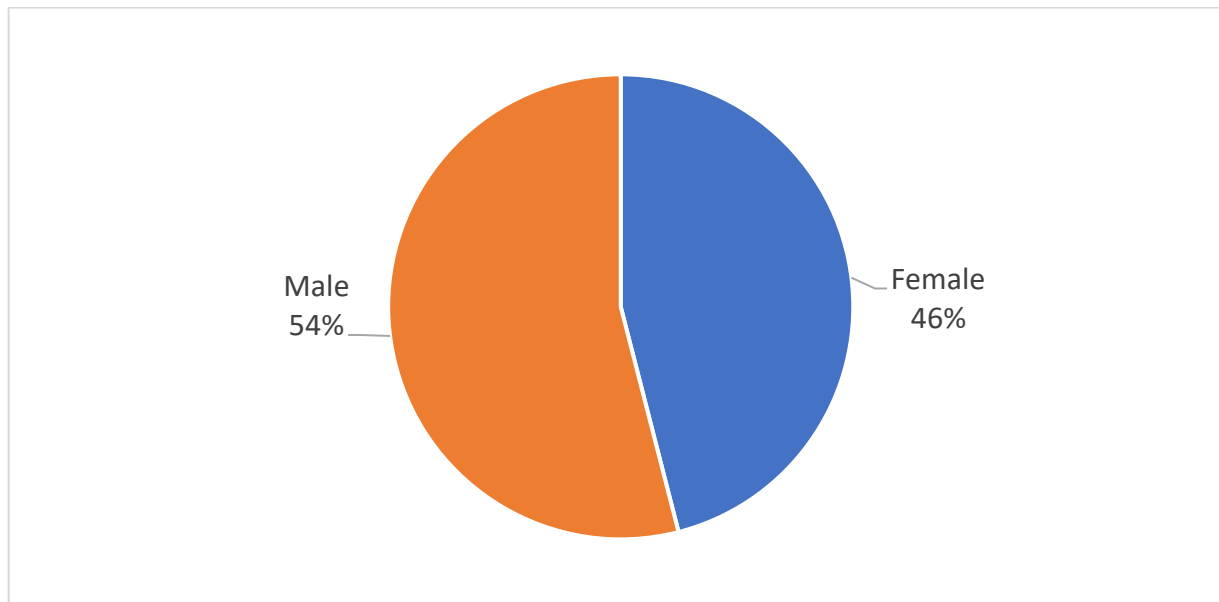


Figure 4.1.2: Gender of the respondents

Figure 4.1.2 shows a pie chart illustrating the gender distribution of the respondents. Based on the survey data obtained from a total of 250 respondents, 115 respondents, equivalent to 46%, were female. Meanwhile, 135 respondents, equivalent to 54%, were male, including both teachers and students. Based on the chart, the number of male and female respondents is relatively similar; however, the number of male students is slightly higher than that of female students.

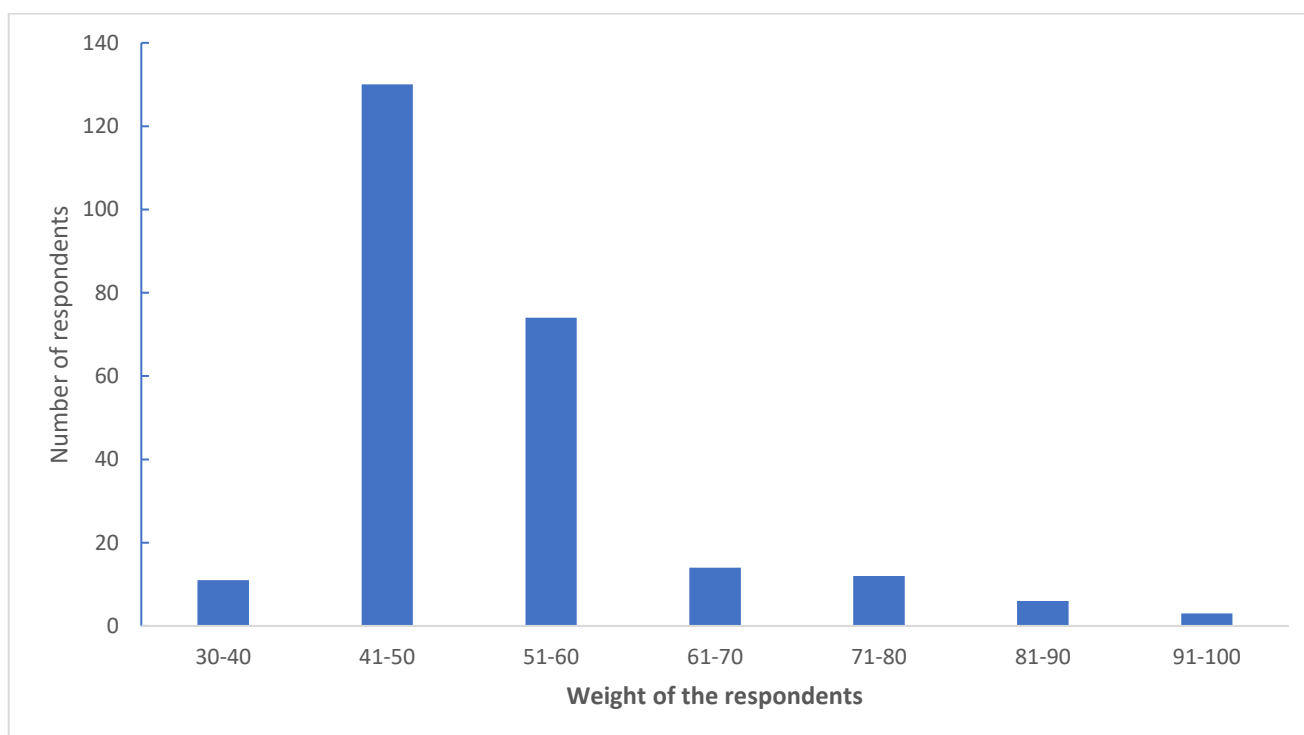


Figure 4.1.3: Weight of the respondents

Figure 4.1.3 illustrates the weight groups of respondents who participated in this survey, consisting of school students and teachers who are involved in the Visual Arts Education subject. The findings indicate that the majority of respondents, totalling 130 individuals, had body weights ranging from 41 kg to 50 kg. The second highest weight category was between 51 kg and 60 kg, comprising 74 respondents, followed by the 61 kg–70 kg and 71 kg–80 kg categories, with 14 and 12 respondents respectively. Respondents with body weights between 81 kg and 100 kg formed a much smaller group, totalling only 9 individuals.

This distribution indicates that most students taking Visual Arts Education classes fall within an ideal weight range. However, a small number of students and teachers were also found to have higher body weights. This situation highlights the need for a study on the suitability of more ergonomic chair designs for use in Visual Arts Education classrooms.

Respondents' Daily Use of Visual Arts Education (PSV) Classroom Facilities

Figure 4.2 shows the percentage of students who use the Visual Arts Education (PSV) classroom facilities on a daily basis. The scale ranges from strongly agree, agree, neutral, disagree, to strongly disagree, reflecting the frequency of students' use of the PSV classroom facilities. The findings indicate that 27 respondents selected the neutral scale. In addition, 5 respondents chose the agree scale, while 173 respondents selected the strongly agree scale, indicating daily use of the Visual Arts Education classroom facilities. The agree and strongly agree scales represent the same category, meaning that respondents use the PSV classroom facilities every day. Meanwhile, the neutral scale indicates that students do not use the classroom every day but still use it frequently during learning sessions. This situation shows that respondents are regularly exposed to the use of existing facilities in the PSV classroom on a daily basis.

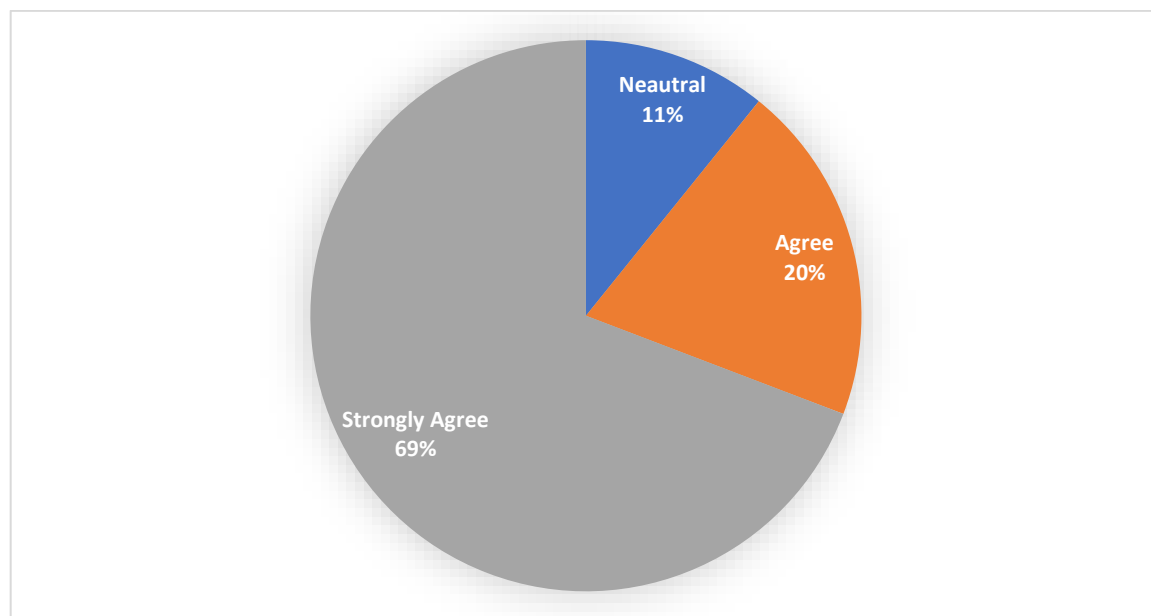


Figure 4.2 Percentage of Students Using Visual Arts Education (PSV) Classroom Facilities Daily

Musculoskeletal Data

Frequency of Pain/Discomfort During the Last Week of Chair Use

Question: *During the last week of using the chair, how often did you experience pain or discomfort?*

Figure 4.3.1 illustrates the percentage distribution of respondents who experienced pain or discomfort while using chairs in the Visual Arts Education classroom. The frequency scale focused on the occurrence of

musculoskeletal pain or discomfort experienced during the last week of using the chairs. The body regions examined in this study included the neck, shoulders, spine, buttocks, thighs, knees, and calves.

Based on the data collected, the findings revealed that the highest percentage (100%) of respondents reported never experiencing pain or discomfort in the calf and knee regions. In contrast, 64.4% of respondents reported experiencing pain or discomfort in the buttock region once or twice during the previous week.

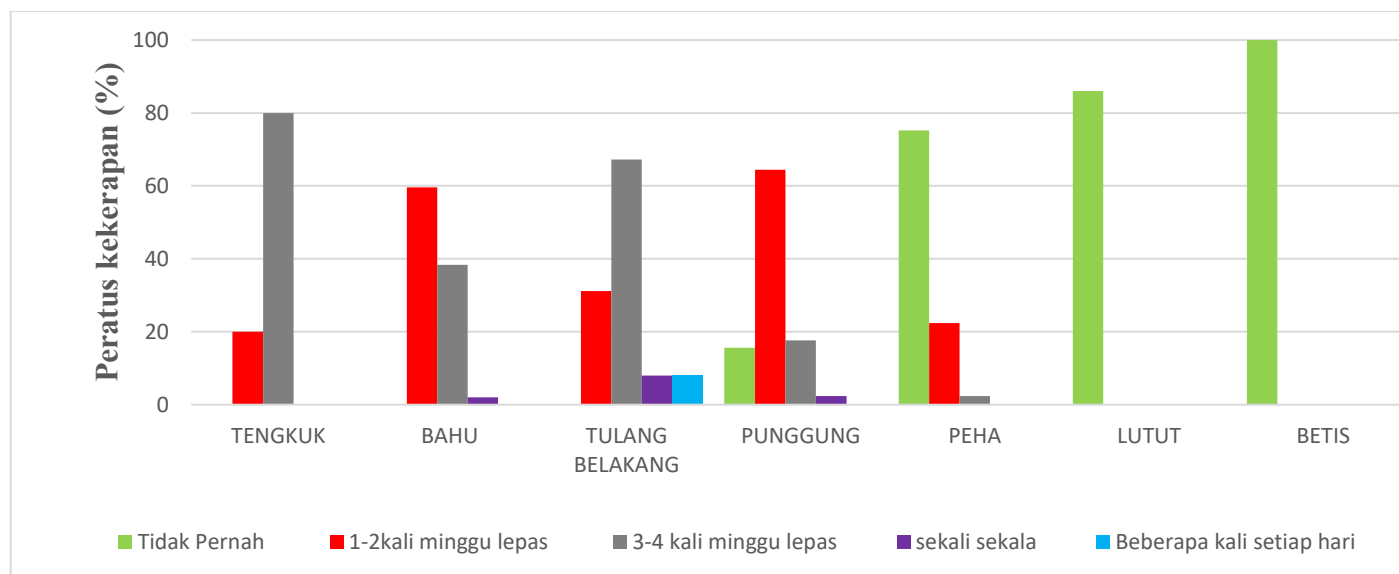


Figure 4.3.1: Bar Graph of Respondents' Frequency of Pain/Discomfort While Using the Chair During the Previous Week

Furthermore, figure 4.3.1 indicates that 80% of respondents reported experiencing pain or discomfort in the neck region 3–4 times during the previous week, while 8% of respondents stated that they experienced occasional pain or discomfort in the spinal region. The researcher also found that the lowest percentage was recorded for respondents who reported never experiencing pain in the buttock region, which accounted for 15.6%. Meanwhile, 20% of respondents reported experiencing pain or discomfort in the neck region 1–2 times during the previous week.

In addition, 2.4% of respondents reported experiencing pain in the thigh region 3–4 times during the previous week, while 2% of respondents experienced occasional pain or discomfort in the shoulder region. The researcher also observed that the highest percentage of respondents reporting no pain or discomfort was recorded in the calf region, as compared to the neck region, despite the neck region showing a relatively high percentage of discomfort at 80%. This finding may be attributed to the importance of respondents' sitting posture while using chairs in the Visual Arts Education classroom, as improper positioning may contribute to an increased likelihood of experiencing neck discomfort.

Figure 4.3.2 illustrates the respondents' pain intensity levels when experiencing pain or discomfort while using the chairs. The pain intensity scale, consisting of no pain, mild pain, moderate pain, painful, and very painful, was used to determine the severity of pain experienced in each musculoskeletal body region. The survey findings revealed that 100% of respondents reported no pain in the thigh, knee, and calf regions. Meanwhile, the highest percentage of respondents reporting mild pain was recorded in the buttock region, with 68.8%. However, a small proportion of respondents (12.4%) reported experiencing moderate pain in the same region, with no respondents reporting severe pain in that area.

Furthermore, the highest percentage of pain intensity in the neck region was recorded at the moderate pain level, involving 34.8% of respondents, while 61.2% of respondents reported experiencing pain in the neck region while using the chairs.

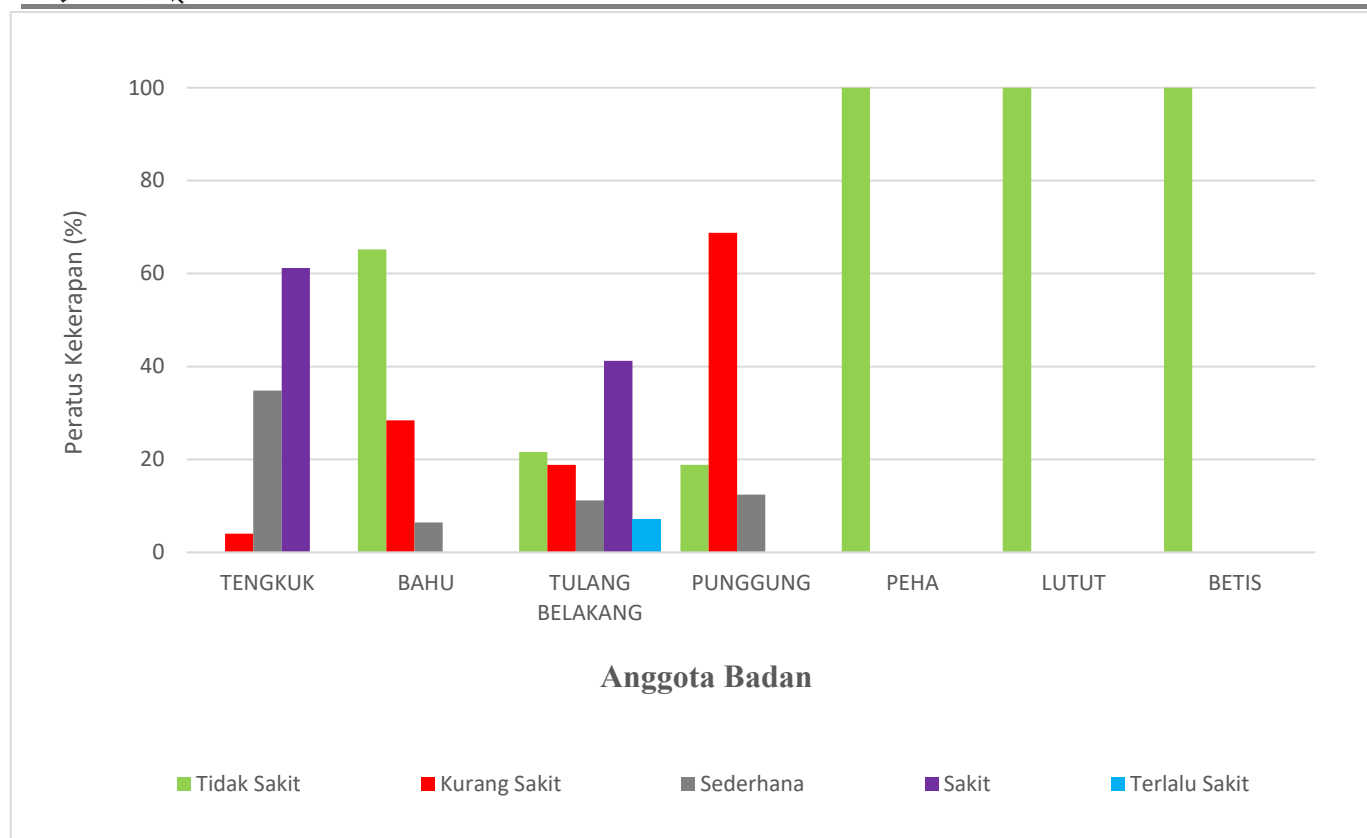


Figure 4.3.2: Bar Graph of Respondents' Frequency of Pain/Discomfort While Using Chairs During the Past Week

This indirectly indicates that the researcher found a high percentage of pain severity among respondents, particularly in the neck and spinal regions, with percentages of 61.2% and 41.2%, respectively. This finding is supported by the study conducted by Al-Hinai et al. (2018), which highlighted that such conditions may increase physical strain and lead to negative health implications, including back muscle tension, neck pain, and headaches. The absence of ergonomically designed chairs within the classroom environment may contribute to the development of poor and unbalanced body posture among students. Furthermore, prolonged discomfort may affect students' ability to concentrate effectively during learning activities, while also causing restlessness due to continuous attempts to find a more suitable sitting position (Al-Hinai et al., 2018).

Proposed Visual Arts Education (PSV) Classroom Chair Design

The graph in Figure 4.9 presents the design recommendations proposed by the researcher to students and educators involved in the Visual Arts Education subject. Five design recommendations were proposed by the researcher, namely that the chair should have a higher backrest, a wider seat surface area to support the buttock region, an additional spinal support feature, an adjustable system, and the inclusion of wheels on the chair.

Addition of Spinal Support

The second objective of this study was successfully achieved through the proposed design of a Visual Arts Education classroom chair, which was developed based on the findings related to existing chair usage issues, the relationship with musculoskeletal disorders, and respondents' body weight. Based on the analysis of respondents' recommendations, the majority suggested that the chair should be equipped with spinal support, making this feature a priority in future chair design development.

This finding indicates that respondents recognised the importance of lumbar support in reducing pressure on the spine caused by prolonged sitting during Visual Arts Education activities. Therefore, the provision of back

support that accommodates the natural curvature of the spine should be considered as a key element in the development of an ergonomic chair design.

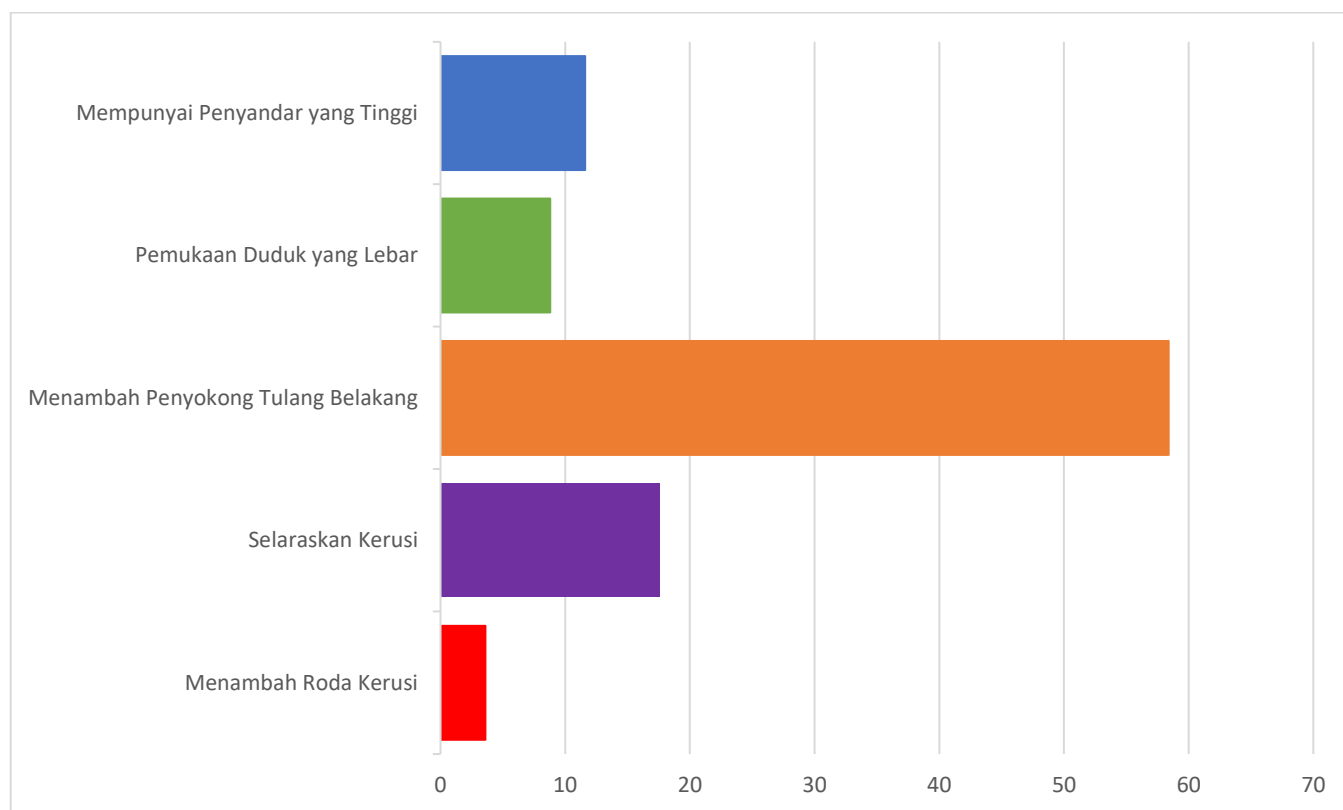


Figure 4.5: Recommendations from Students and Educators of the Visual Arts Education Subject

CONCLUSION

This study successfully achieved all of its objectives by identifying that the existing chairs used in Visual Arts Education classrooms do not meet ergonomic principles, resulting in musculoskeletal discomfort such as back, neck, shoulder, and lower back pain among students. The findings indicate that factors such as backrest support, lumbar support, seat dimensions, and compatibility with students' anthropometric measurements have a greater influence on comfort than chair height or body weight.

The study also developed a framework for the design of Visual Arts Education chairs that integrates musculoskeletal issues, ergonomic principles, and anthropometric data. This framework serves as a useful guideline for researchers, product designers, furniture manufacturers, and the Ministry of Education in developing safer and more comfortable classroom furniture.

For future research, it is recommended to involve a larger sample size, develop and test ergonomic chair prototypes, and incorporate smart technologies such as posture sensors to enhance chair performance. Overall, this study contributes to the development of more ergonomic Visual Arts Education chairs, with the potential to improve students' comfort, health, and learning concentration.

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