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Ergonomic Evaluation of Workstations Regarding Comfort and Practical Work Outcomes for TSM Students at SMK N 1 Denpasar

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Abstract

This condition can lead to health issues, ranging from mild ailments like heat rash and heat cramps to serious conditions such as heat stroke.Consequently, controlling thermal conditions within buildings is a crucial aspect, particularly for structures used for intensive and sustained activities. According to ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), thermal comfort is the state in which building occupants are satisfied with the surrounding environmental temperature. Physical observation results (average temperature of 31.6°C, lighting of 163 Lux, and noise level of 87 dB) clearly indicate that the existing workshop conditions do not yet meet the standards set. (Regulation of the Minister of Manpower) No. 5 of 2018 and the ILO. Workstation conditions have a positive and significant effect on the work outcomes of students in the Motorcycle Engineering (TSM) program at SMK 1 Denpasar during practical training. This implies that the better the implementation of workstation conditions, the higher the students' work outcomes. Workstation conditions have a positive and significant effect on student comfort during practical training in the TSM program at SMK 1 Denpasar. This implies that the better the implementation of workstation conditions, the greater the level of student comfort. Student comfort has a positive and significant effect on the work outcomes of students in the TSM program at SMK 1 Denpasar during practical training. This implies that the higher the level of student comfort, the higher the students' work outcomes. Student comfort acts as a partial mediating variable in the influence of workstation conditions on the work outcomes of students in the TSM program at SMK 1 Denpasar during practical training.

Keywords: *Workstation Ergonomics, Comfort and* Practical Work Outcome

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INTRODUCTION

This condition can lead to health issues, ranging from mild ailments like heat rash and heat cramps to serious conditions such as heat stroke (Parsons, 1993). Consequently, controlling thermal conditions within buildings is a crucial aspect, particularly for structures used for intensive and sustained activities. According to ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), thermal comfort is the state in which building occupants are satisfied with the surrounding environmental temperature.

In tropical regions, thermal comfort is generally achieved at air temperatures of 22–28°C with a relative humidity of 70–80%. This comfort is significantly influenced by air circulation, radiant temperature, and air temperature. Rooms with poor air circulation tend to feel hot, stuffy, and humid, thereby reducing user comfort.

Through the Regulation of the Minister of Public Works Number 29/PRT/M/2006, the government stipulates that building comfort encompasses spatial, auditory, visual, and thermal comfort. These four aspects are interconnected and serve as indicators of the building environment's quality. Educational buildings—specifically schools—face higher demands because they serve as venues for teaching and learning processes that require a conducive environment.

Vocational High Schools (SMK) are educational institutions that emphasize practice-based learning. During workshop-based practical activities, students are essentially positioned and treated similarly to workers in an industrial setting. In these practical learning sessions, students are required to complete tasks—such as motorcycle servicing—adhering to the procedures, time standards, and quality benchmarks prevalent in the business and industrial sectors. The availability of adequate practical facilities and infrastructure is a determining factor in learning success. A key facility in vocational schools is the practical workshop, where students apply theoretical knowledge to real-world work activities. This approach aligns with the vocational school's objective: to produce graduates who are not only technically competent but also possess the work ethic and productivity characteristic of professional workers. The motorcycle engineering workshop is a work environment characterized by high levels of physical activity, the use of mechanical equipment, and potential sources of heat, noise, and uneven lighting.

The working environment and workstation conditions in the workshop have not been optimally managed. The current layout of the motorcycle workshop reflects high activity density and a suboptimal arrangement of work areas, which restricts freedom of movement and disrupts workflow. The working environment is characterized by high temperatures due to poor air circulation, high noise levels from simultaneous practical activities, and lighting that is inadequate for tasks requiring precision. The existing layout fails to adhere to ergonomic principles, resulting in uncomfortable working postures that can lead to fatigue and the risk of musculoskeletal disorders. These conditions indicate that the current layout does not support the comfort, safety, or effectiveness of practical activities—factors that significantly influence both student comfort and work outcomes. These indicators are interconnected and determine the quality of the learning environment within the workshop.

METHODOLOGY

This study employs the path analysis method using SPSS software. The Likert scale is a measurement scale used to measure the attitudes, opinions, and perceptions of an individual or group regarding a specific object, phenomenon, or statement. The sample consists of 60 respondents, and data collection was conducted via questionnaires. The explanatory survey in this study goes beyond merely describing variables (such as workshop conditions or the level of work output); instead, it aims to explain why and how the variable of comfort acts as a bridge (mediator) that strengthens or weakens the influence of the workstation on the learners' work output.

RESULTS AND DISCUSSION

A. The Workstation Condition variable has a coefficient of 0.747, indicating a positive influence on Learner Comfort; this means that an improvement in Workstation Conditions leads to an increase in Learner Comfort, and vice versa. This study analyzed the impact of Workstation Conditions and Learner Comfort on Learner Work Outcomes using the SPSS 25.0 for Windows software application. The Workstation Condition variable has a coefficient of 0.442, indicating a positive influence on students' work outcomes; this means that an improvement in workstation conditions leads to an improvement in students' work outcomes, and vice versa. The Student Comfort variable has a coefficient of 0.343, indicating a positive influence on students' practical work outcomes; this means that an increase in student comfort leads to an improvement in students' practical work outcomes, and vice versa.

The workstation ergonomics in the TSM workshop at SMK Negeri 1 Denpasar are suspected of not fully meeting applicable ergonomic standards, potentially resulting in suboptimal comfort and work outcomes for students during practical sessions.

The term "existing workshop" refers to the physical conditions, infrastructure, management, or operational systems currently in place and functioning. It describes the actual state ("as-is") of the workshop prior to any transformation, development, layout optimization, or implementation of new technologies (such as digitalization or conversion to electric vehicles). The significant impact of the workstation setup on student discomfort is evidenced by the fact that the existing workshop's air temperature reaches 31.6°C, exceeding the safety standard set by the Minister of Manpower Regulation No. 5 of 2018 (23–30°C). This excessive thermal exposure disrupts the students' thermoregulatory systems, triggers mild dehydration, and accelerates muscle fatigue during vehicle servicing tasks.

The Influence of Workstation Conditions on Student Comfort

The analysis results regarding the influence of Workstation Conditions on Student Comfort indicate that the Workstation Conditions variable has a positive and significant effect on Student Comfort during practical training for TSM-major students at SMK 1 Denpasar. This implies that the better the implementation of Workstation Conditions, the greater the Student Comfort; thus, the second hypothesis is accepted.

The Influence of Workstation Conditions on Students' Practical Work Outcomes

The analysis of the influence of Workstation Conditions on students' work outcomes indicates that the Workstation Conditions variable has a positive and significant effect on the work outcomes of students in the TSM (Motorcycle Engineering) program at SMK 1 Denpasar. This means that the better the implementation of Workstation Conditions, the higher the level of work outcomes achieved by the students in the TSM program at SMK 1 Denpasar; consequently, the first hypothesis is accepted**.**

The Influence of Student Comfort on Student Work Results

The analysis of the influence of student comfort on student work results indicates that the student comfort variable has a positive and significant effect on the work results of students in the TSM (Motorcycle Engineering) program at SMK 1 Denpasar. This means that the greater the level of student comfort, the higher the level of student work results in the TSM program practical work at SMK 1 Denpasar; consequently, the third hypothesis is accepted.

The Mediating Role of Student Comfort in the Influence of Workstation Conditions on Student Work Outcomes

The results of the Sobel test indicate that the Workstation Conditions variable has a positive and significant effect on Student Work Outcomes during the practical training of TSM (Motorcycle Engineering) students at SMK 1 Denpasar, mediated by Student Comfort; this implies that Student Comfort strengthens the influence of Workstation Conditions on Student Work Outcomes, thereby confirming the fourth hypothesis.

CONCLUSION

Physical observation results (average temperature of 31.6°C, lighting of 163 Lux, and noise level of 87 dB) clearly indicate that the existing workshop conditions do not yet meet the standards set. (Regulation of the Minister of Manpower) No. 5 of 2018 and the ILO. Workstation conditions have a positive and significant effect on the work outcomes of students in the Motorcycle Engineering (TSM) program at SMK 1 Denpasar during practical training. This implies that the better the implementation of workstation conditions, the higher the students' work outcomes. Workstation conditions have a positive and significant effect on student comfort during practical training in the TSM program at SMK 1 Denpasar. This implies that the better the implementation of workstation conditions, the greater the level of student comfort. Student comfort has a positive and significant effect on the work outcomes of students in the TSM program at SMK 1 Denpasar during practical training. This implies that the higher the level of student comfort, the higher the students' work outcomes. Student comfort acts as a partial mediating variable in the influence of workstation conditions on the work outcomes of students in the TSM program at SMK 1 Denpasar during practical training. This implies that student comfort serves to strengthen the impact of workstation conditions on the students' work outcomes.

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