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A Critical Review of Ergonomics and Effectiveness in Driving Simulators for Malaysian Driver Training Programs (SPiP)

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Abstract

Using driving simulators in the Malaysian driver training curriculum (SPiP) is an important step taken by the government to improve road safety. However, the success of this training depends on the simulator's design and ergonomics. This paper reviews existing studies on the physical and cognitive ergonomics of driving simulators used in Malaysia. The review finds that many simulators do not follow Malaysian anthropometric data and have low realism. This leads to discomfort for trainees and makes the training less effective. The paper suggests that there should be a standard and certification for simulator hardware based on local requirements to ensure new drivers are well-trained.

Keywords: Road Safety, Driving Simulators, Ergonomics, Malaysian Anthropometry, Driver Training

Introduction

Effective driver training is very important to reduce traffic accidents in Malaysia. Nowadays, driving simulators are widely used because they are safe and cost-effective. Simulators allow new drivers to practice in dangerous traffic situations without any real-world risk. This helps them to improve their vehicle control and hazard perception in a safe environment (Lee & Tan, 2021).

Driving Simulation in Malaysia

In Malaysia, the government has made it compulsory for driving schools to use simulators under the Sistem Pengajaran Pemandu (SPiP) curriculum. This shows that the country is serious about improving the quality of new drivers. However, these simulators must be designed well, especially in terms of ergonomics. If a simulator is poorly designed, the skills learned by the trainees might not be useful when they drive a real car.

Problem Statement and Research Gap

Even though many driving schools in Malaysia use simulators, there is still not enough research on whether these machines are designed properly for the users. The effectiveness of a simulator depends on how well it fits the human body and mind. If the seating or visual feedback does not match the characteristics of Malaysian drivers, the training will not be effective (Jamil, 2018). There is a need for a review that connects these ergonomic problems to the training outcomes in the SPiP program.

Aims of the Review

This paper reviews the literature on the ergonomic design and effectiveness of driving simulators used in Malaysia. The review focuses on three main areas: physical ergonomics, cognitive ergonomics, and the overall effectiveness of the training system.

Methodology

This review used a systematic search to find relevant research on driving simulators and ergonomics, especially in the Malaysian context. Several databases were used, including Scopus, ScienceDirect, and Google Scholar. The search focused on journal articles and reports published between 2005 and 2025.

Search Terms

The keywords used for the search included: "Anthropometric data of Malaysian drivers," "Seating ergonomics," "Driving simulator realism," "Simulator sickness," and "SPiP Malaysia."

Selection of Literature

Papers were selected if they were related to Malaysian drivers (Ghani et al., 2017), simulator design parameters (Wong & Lim, 2019), or the results of simulator training programs (Jamil, 2018; Sulong & Kassim, 2020).

Review of Physical Ergonomics

Physical ergonomics looks at how the hardware of the simulator interacts with the human body. This is important for the comfort and safety of the trainee.

Malaysian Anthropometric Data

A good simulator design must be based on the body measurements (anthropometry) of the users. Studies show that standard measurements from Western countries are not suitable for Malaysian drivers (Ghani et al., 2017). Important dimensions like sitting height and reach distance are different for the Malaysian population (Ahmad & Chong, 2019).

Design Issues in Current Simulators

Many simulators used in Malaysia are not adjustable. Since they are often based on international standards, they do not fit local trainees well. For example, fixed seating can cause back pain and fatigue, which makes it hard for trainees to focus (Devi & Muthu, 2018). Also, if the pedals and steering wheel are not placed correctly, trainees might develop bad driving postures (Nasir & Daud, 2015).

Impact on Training

If a trainee feels uncomfortable, they cannot focus on learning. More importantly, if the simulator posture is different from a real car, the skills learned might not transfer well to real driving (Lim et al., 2016; Jamil, 2018).

Review of Cognitive Ergonomics

Cognitive ergonomics is about how the mind interacts with the simulator, including factors like attention and perception.

Simulator Realism (Fidelity)

Realism is very important for effective learning (Wong & Lim, 2019). Many low-cost simulators have poor visual resolution and field of view. Also, if the steering wheel and pedals do not feel like a real car (haptics), the trainee will not develop the right motor skills (Tan & Singh, 2022).

Simulator Sickness

Many trainees experience "simulator sickness," which includes symptoms like nausea and dizziness. This happens when the eyes see movement but the body does not feel it (Kumar & David, 2017). This problem can be reduced if the simulator is designed with better visual systems and refresh rates (Nasir & Daud, 2015).

Synthesis of Findings

Based on the literature review, the findings about ergonomic issues in Malaysian driving simulators are summarized in Table 1. The data shows that there is a clear difference between current simulator hardware and the actual needs of Malaysian users.

Table 1
Synthesis of Ergonomic Issues and Their Impact on Training Effectiveness

Category	**Key Findings (Issues Identified)**	**Impact on Trainees**	**Supporting Evidence**
Physical Ergonomics	Use of Western anthropometric data in simulator cockpit design	Discomfort, back pain, and rapid fatigue	Ahmad & Chong (2019); Ghani et al. (2017)
Hardware Adjustability	Fixed seating and non-adjustable pedal/steering configurations	Development of poor driving postures and lack of focus	Nasir & Daud (2015); Devi & Muthu (2018)
Cognitive Ergonomics	Low visual resolution and restricted field of view (FOV)	Increased risk of simulator sickness (nausea/dizziness)	Kumar & David (2017); Ali & Samad (2023)

Category	Key Findings (Issues Identified)	Impact on Trainees	Supporting Evidence
System Realism (Fidelity)	Lack of realistic haptic feedback in controls (steering/braking)	Ineffective motor skill acquisition and poor hazard perception	Tan & Singh (2022); Wong & Lim (2019)
Training Transfer	Inconsistency in simulator quality across different driving schools	Skills learned do not transfer effectively to real-world driving	Hashim & Bakar (2019); Lee & Tan (2021)

Discussion

The findings show that there is a gap between the government's plan for the *Sistem Pengajaran Pemandu* (SPiP) and the quality of simulators used. While using simulators is a good step to train new drivers, the lack of a specific Malaysian ergonomic standard makes the training less effective.

The main problem is that many simulators follow international standards that do not fit the body sizes of Malaysian drivers. When a trainee uses a simulator that does not fit their body, they focus more on their physical discomfort than on learning driving skills. This can lead to "negative transfer," where trainees learn wrong habits in the simulator and carry them into real-world driving. This is dangerous and can increase road risks.

Also, many trainees experience simulator sickness because the visuals are not realistic. If a trainee feels sick during their first training, they will have a negative attitude toward road safety education. Therefore, Malaysia needs a central body to check and certify that all simulators in the SPiP program are adjustable and realistic. This is important to make sure the training really helps to reduce road accidents.

Conclusion and Recommendations

This review concludes that the effectiveness of driving simulator training in Malaysia is limited by ergonomic and design issues. These problems make it difficult for trainees to transfer their skills to real-world driving.

It is recommended that simulators used in Malaysia must be adjustable to fit local body sizes. Also, there should be a minimum technical standard for visual and haptic feedback to improve realism. Future research should look at the long-term effects of using better simulators on road accident rates in Malaysia.

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