

DRIVERS' READINESS TO USE CAR DRIVING SIMULATOR AS A TOOL TO IMPROVE DRIVING SKILL: A PRELIMINARY STUDY

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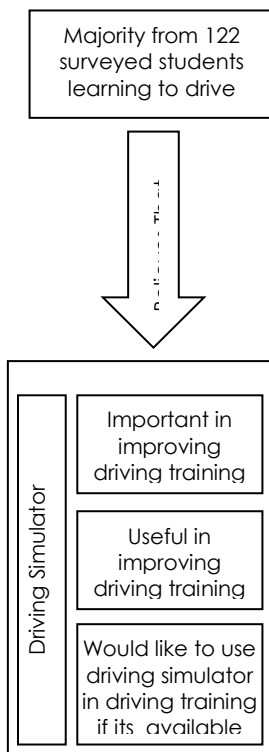
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Graphical abstract



Abstract

Driving simulators have existed since the 1960s, but for a long time they remained too expensive to be used widely for training purposes. As IT related technology improved, the cost of driving simulators goes down in the last few years. Today, driving simulators have been used as a training device in the basic driver training. In developed countries the use of simulator in driving education is not new. In Malaysia, however, the use of simulators in training is quite new compared to other Asian countries. This paper presents the results of preliminary study on the readiness of Malaysian driver to use car driving simulator in training and education prior to driver licensing. Survey method was used to get information on drivers' perception toward the introduction of driving simulator in selected driving institutes. The results of this study showed that all respondents agreed on the importance and usefulness of the driving simulator in improving the driving training process. Based on the result of this study, it is suggested that driving simulator should be implemented in the driving curriculum in order to produce competent driver.

Keywords: Driving simulator; driving skill; driver training; driving curriculum

Abstrak

Simulator memandu telah mula wujud sejak tahun 1960an, tetapi semenjak sekian lama ia masih terlalu mahal untuk digunakan secara meluas bagi tujuan latihan. Dengan bertambah baiknya teknologi IT, kos simulator memandu telah berkurangan di dalam beberapa tahun kebelakangan ini. Hari ini, simulator memandu telah digunakan sebagai peranti latihan di dalam latihan asas memandu. Di negara-negara maju, penggunaan simulator di dalam pendidikan memandu bukanlah sesuatu perkara yang baru. Walaubagaimanapun, di Malaysia penggunaan simulator memandu adalah agak baru berbanding negara-negara Asian lain. Kertas kerja ini membentangkan kajian awal terhadap kesediaan pemandu Malaysia untuk menggunakan simulator memandu di dalam latihan dan pendidikan sebelum penganugerahan lesen memandu. Kaedah tinjauan digunakan untuk mendapatkan maklumat persepsi pemandu-pemandu terhadap pengenalan simulator memandu di dalam institut-institut memandu terpilih. Keputusan kajian ini menunjukkan semua responden bersetuju dengan kepentingan dan kegunaan simulator memandu di dalam menambahbaik proses latihan memandu. Berdasarkan kajian ini, adalah

dicadangkan bahawa simulator memandu patut diimplementasikan di dalam kurikulum memandu bagi menghasilkan pemandu yang kompeten.

Kata kunci: Simulator memandu; kecekapan memandu; latihan pemandu; kurikulum memandu

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1.0 INTRODUCTION

Malaysia is one of the countries that ranked highest in the number of road traffic accidents. There are many factors that contributed to this statistics; one of them is the deficiency in pre-driving skill training in the overall driver education and training curriculum. It is quite easy to argue that if we are able to produce knowledgeable and competent driver, our road will be safer and the number of traffic accident can be reduced.

In the case of Malaysia, the process of licencing drivers was based on existing curriculum where the focus is mainly developing skills and control, with less emphasis on safety and courtesy. For example, avoiding accidents and predicting hazards on the road is not included in our curriculum, whereas this aspect is vital in driver lesson. Those skills can only be acquired through the use of simulator in training as it involves training in a relatively unsafe condition.

Although simulators have existed since the 1960s, for a long time they remained too expensive to be used widely for training purposes. The fast development in technologies such as computers has become ever more powerful, and their price-performance ratio has been getting increasingly better. This means that the price of simple simulators (that is, simulators that do not imitate the feeling that one is driving) has gone down considerably. In Netherland for example in 2010, it is estimated around 100 simulators were being used in basic driving training [1].

Since driving lessons are quite expensive in Malaysia, training devices that can save money on driving lessons are very attractive, certainly for the larger driving schools who can then offer a cheaper driver training. However, it is not yet clear whether training on a simulator can in fact reduce the number of practical driving lessons. One study showed that the chance of passing the driving test is 4 to 5% higher for learner drivers who followed a simulator training [2]. If we look at the aspect of driving itself, one of the important aspect is on proper handling of vision and attention. Car simulators are designed to improve drivers' visual attention, especially lane keeping and turning, as well as higher order skills like Hazard Perception and Collision Avoidance. Previous research strongly support the use of virtual reality driving simulators as a sensitive and effective tool for driving assessment, offering compelling evidence highlighting their potential effectiveness for providing retraining to those who have suffered a neurological and/or physical compromise [3]. Driving simulators are electronic devices that are

named for exactly what they do: imulate the experience of driving. The actual size of a driving simulator depends on its intended use.

In a driving simulator, we actually sit in a model of a vehicle and use a steering wheel and other vehicle components, rather than the floor of your living room holding a video controller. Driving simulators can be used by anyone who has access to one, and they are used for entertainment, as well as research and educational purposes. Some driving simulators of the arcade variety also include gas and brake pedals. Some of these are more advanced than others, and allow players to experience movement; however, for the most part they focus on graphic displays and sounds to help you feel as if you are really driving. There are also highly advanced driving simulators used for research and educational purposes. These driving simulators can be used for driver education classes, as well as in experiments conducted by researchers.

Learning how to drive using car simulator actually involves experiential learning environments. Experiential learning is a process of reconstructing the experiences into knowledge and it is a holistic approach whereby it involves the influence of experience, emotions, cognition and environmental factors in learning process [4]. Theoretically, there are four learning modes or process in experiential learning: Concrete Experience (CE), Abstract Conceptualization (AC), Reflective Observation (RO), and Active Experimentation (AE). Although, different individuals may take different order, step or approach, for example when we learn to drive, as in the Concrete Experience (CE) stage we physically experience the feel behind the wheels (car engine, vibration, speedometer, etc.) This will help us in creating basic understanding which involves Reflective Observation (RO) about the task and enable us to reflect or reviewe the past experience. Later, in Abstract Conceptualization (AC) stage, we try to think new ways or ideas to improve our driving skills. Every new attempt will consider as Active Experimentation (AE). The modes of the process is presented as a cycle (see Figure 1).

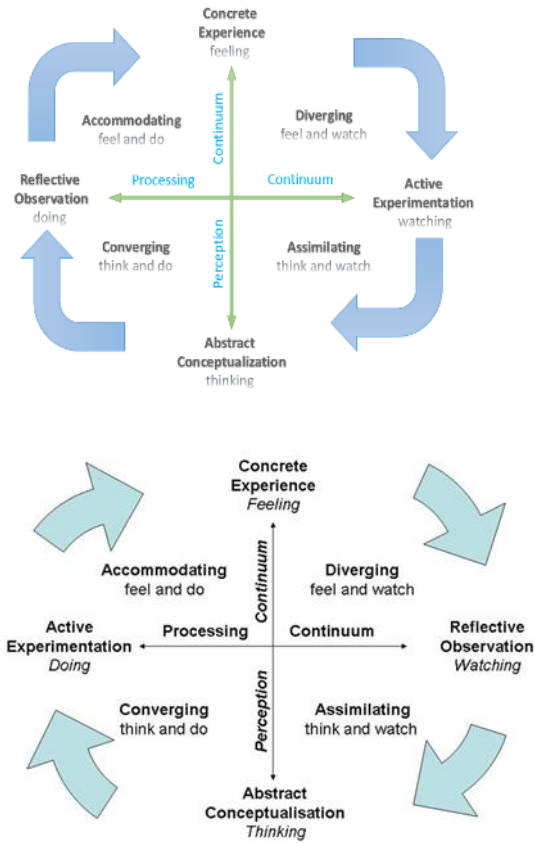


Figure 1 Experiential Learning Cycle

So how do these simulators work? In a typical simulator, the driver sits on a chair, facing one or more displays that show a first-person view through a driver seat, controlling a driving simulation using a steering wheel and gears while utilizing their sense of sight and hearing. Because of this, the types of simulators can vary, from using only one display to up to three, putting the simulators inside an enclosure to better mimic the experience of driving inside a vehicle, and some even use motion enabled platforms. Through driving simulators, drivers can get the feel of driving as if they are in an actual driving environment in a controlled and safe situation. Driving simulators are widely used in driving lessons and in undertaking driving related research. The following table list some of the countries that uses driving simulators as a teaching aide to increase the effectiveness of driving lessons.

Table 1 Usage and duration of simulators by countries

#	Countries	Use of Driving Simulators	Duration of Simulator Uses
1	North America	Researches, Driving Lessons	5 Hours
2	France	Researches, Driving Lessons	4 Hours
3	South Korea	Researches, Driving Lessons	4 Hours
4	Singapore	Researches, Driving Lessons	5 Hours
5	Japan	Researches, Driving Lessons	4 Hours
6	Australia	Researches, Driving Lessons	6 Hours



Figure 2 Honda Driving Simulator in Japan for Driving School [8]



Figure 4 Driving Simulator in an Australian Driving School [10]



Figure 3 Driving Simulator in South Korea [9]

The use of virtual instructor in driving simulators can save driving instructor's time. This makes a simulator attractive to driving schools, in spite of the relatively expensive purchasing costs. However, it is not certain whether replacing the driving instructor by a machine as a good idea. But one advantage of machines is that they will never fail to provide feedback. Another point is that in the current simulators for training purposes, the virtual instructor cannot see which way

a learner is looking. Therefore, a virtual instructor does not give the learners any feedback about their looking behaviour. The question may arise is that are simulators in the basic driver training good for road safety? Not much research has been done into the safety related contribution of simulator training in the basic driver training. The research that is available focuses on the effect that simulator training has on hazard perception. In the United States, for example, [5] showed that a lower crash rate during the first years after passing the driving examination was found for learners who during their driver training had lessons in skills like risk awareness, hazard perception, and making decisions under time pressure, than for learners who had not received such simulator lessons. Another study [6] found that novice drivers became aware of potential hazards considerably more after a simulator training in hazard perception. This also happened in situations that had not been trained; this means that transfer had taken place. In China, [7] have also developed an effective simulator training for novice drivers. In the Netherlands, driving simulators in basic skill training are only used for learning the basic skills and not for higher skills like hazard perception and risk awareness.

2.0 RESEARCH PROBLEM

In Malaysia, the current lessons and training system requires learner driver to attend theoretical driving classes before a few hours of practical training followed by on-track test and on-the-road test. After passing the JPJL2A : Drivers Education Curriculum Class Attendance, candidates are certified to sit for a computerized Part 1 Theoretical Test (Road Rules & Regulations). Candidates must obtain a mark of at least 42 out of 50 (84%) to pass. After passing, candidates must attend another 6 hours of Pre-Learner (L) class in order to be given a Learner Driver License (LDL), which permits them to drive at a controlled driving course and on the road accompanied by an instructor. Candidates with LDL must go through 8 hours of Practical training followed by 2 hours of Qualifying Test at the Institute (QTI). After this training, candidates will sit for Test I & II, and should the candidates pass, they will receive a P license (PDL) for 2 years.

Observations and interviews conducted with some driving instructors shows that the 3 hours Pre-L theory class and 3 hours of practical class has a few weakness that should be improved. For example, the theory class for getting to know the basis of the vehicle only shows the vehicle without the practical aspect. Candidates also voiced out their boredom for this class. It would be better if simulator lessons are introduced at this part of the lesson before candidates are exposed to actual driving conditions on the road.

The QTI and KEJARA module can also be improved with simulator lessons.

3.0 METHOD

This study employed survey research method using structured interview. A set of questionnaire was used to get information from respondent who came to the Driving institute for registration. The study was conducted from July to December 2012.

3.1 Sample and Location of Study

The study involved 122 driving candidates that underwent training at several driving institute in Selangor and Kuala Lumpur to see the need of simulator use in driving lessons. Another set of sample of 35 people were created from instructors and staffs data set of the driving institutes. One set of questionnaire relating to perception and the readiness for simulators was produced to obtain data on the respondents' demographic, perceptions and acceptances.

3.2 Instrument

This questionnaire consist of 4 parts: the first part is for the respondents demography, such as gender, age, education, types of employment and their knowledge of simulators; the second part consist of 4 questions relating to their knowledge of simulators' functions; the third part is the advantages of simulators; and the fourth part is about their acceptances. Reliability analysis shows that this instrument is reliable with an Alpha-Cronbach score of 0.6 to 0.9.

4.0 RESULT AND DISCUSSION

The main objective of the study is to explore drivers' readiness to use car driving simulator as part of the driving curriculum and training. With regard to the drivers readiness in using simulator, this study focused on three main issues; respondents' perception towards the function of simulator as an education tool, the advantages of using simulator and their readiness to use car driving simulator.

The results of the study generally showed that nearly all respondents gave positive regards which were either in agreement or very much in agreement with the introduction of simulators as a part of the module and curriculum for driving lessons. This can be seen in Table 2 which shows that the three factors namely the simulators' functionalities (eq. early exposure and reducing lesson's duration); advantages (eq. free from risk of accident and not boring); and the society's acceptance (eq. will use simulator if implemented) received high agreement

Table 2 Means and standard deviations of respondents' perceptions towards the importance of simulators in Malaysia

No	Functionality factor	Means and Standard Deviations				
		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
		1	2	3	4	5
1	Simulators are necessary for driving's early exposure	-	-	-	4.18 (.84)	-
2	Use of simulator's technology is in line with the current development and other countries	-	-	-	4.10 (.83)	-
3	Simulators can reduce lesson's duration	-	-	-	4.06 (.85)	-
4	Simulators are hands-on, more practical and easier to understand	-	-	3.90 (.98)	-	-
Advantage Factor						
1	Able to provide and early experience about a vehicle and its components	-	-	-	4.17 (.76)	-
2	Provide early exposure on road conditions and driving	-	-	-	4.14 (.77)	-
3	Lesson elements like hazard detections are important	-	-	-	4.15 (.73)	-
4	Assist the IM in training and Pre-L sessions	-	-	-	4.12 (.83)	-
5	Simulators are safer and free from the risk of accidents	-	-	-	4.03 (.88)	-
6	Simulators can provide a much more effective delivery method for students	-	-	-	4.08 (.84)	-
7	Provide an accurate driving lessons safely	-	-	-	4.08 (.86)	-
8	Exciting and is not boring like a class lecture	-	-	-	4.02 (.98)	-
9	Cost effective because there are no vehicle maintenance, course rental, testers and instructors	-	-	3.94 (1.01)	-	-
Acceptance Factor						
1	I would use a simulator if given the opportunity	-	-	-	4.16 (.81)	-
2	I would use a simulator if it is required by authorities	-	-	-	4.01 (.83)	-
3	I have no problem to pay more on simulator lessons	-	-	3.46 (1.21)	-	-

5.0 ISSUE AND RECOMMENDATION

Despite the usefulness of the simulator, there are some issues that needs to be considered to ensure that simulator's usage can provide the best improvement towards driving lessons and tests. These issues includes accuracy of virtual environment's rendering at driving velocity, accuracy of data, and standardisation of results. When using a simulator in driver training, its technical quality is important, and so is the quality of the simulator lessons and the way

in which these lessons are embedded in the driving course. In other country simulators are beginning to be widely used for basic driving training [8,9,10,11]. Malaysia should not be left behind in utilizing this great technology for the benefit of everyone.

6.0 CONCLUSION

The results of this study shows that Malaysian driver are in fact ready to accept simulator as part of the training lesson. Result from ongoing worldwide simulator related research activities increasingly show that simulator based training can contribute to the improvement for novice drivers in higher order skills such as hazard perception. Furthermore, as candidates, they can get an early experience in

learning techniques like steering, changing gear, and other hands-on activities, as well as other basic activities like starting the engine, fastening the seat belt and controlling the clutches and accelerator, before driving and actual vehicle. The application of driving simulators translates into a reduction in driving school's maintenance cost as simulator maintenance cost is significantly lower compared to an actual vehicle. Considering the above, it is recommended that driving lessons in simulators are incorporated into the current curriculum. The most appropriate part for this implementation is in theoretical class before the candidates are given the L license where they are taught the basic vehicle safety.

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