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RESEARCH ARTICLE

Validation of Malaysian Driving Style Self-Assessment with Observational Road Study

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ABSTRACT - Along with the increasing application of a self-assessment questionnaire to recognize the driving style, questions have been raised about the possibility of reporting bias because of the driver's misjudgment. A hazy reference point was the cause since drivers lack objective input directly tied to their driving behaviour when answering a self-assessment questionnaire. This study aims to validate the results of a driving style self-assessment questionnaire with road studies for Malaysian drivers. A total of 20 drivers' driving styles were recorded and evaluated by the two designated observers. The driver completed the driving self-evaluation questionnaire (18 items) after finishing the two designated routes (familiarization and experiment route). In comparison, the observer evaluated the driver by using two forms: 1) a driver evaluation questionnaire (18 items) after the experiment and 2) an on-road driver observation form (25 items) during the experiment. Inference statistics analyzed the data using regression, Pearson correlation, Wilcoxon z-value, Analysis of Variance (ANOVA), and reliability test. For the reliability test, the questionnaire illustrates the consistency and reliability of the set questionnaire used in this study, ranging from acceptable to good. However, the result shows no significant correlations between driver and observer with on-road driver observation forms for error/violation during driving activities. Besides, there were significant differences between the driver and observer regarding driving style evaluation. The over-positive appraisal was higher among drivers with higher error/violation scores and with the ones that the observer evaluated. The theoretical and practical significance of the self-driving questionnaire is addressed.

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1.0 INTRODUCTION

In general, the term "driving style" refers to the technique that the driver prefers, including the selection of driving speed, headway, and level of attentiveness [1], [2]. Investigating driving style is a continuing concern within the field of transportation to adjust to the drivers' needs, potentiate their acceptability, and ultimately meet drivers' preferences in a certain situation and environment [3]–[5]. So, it is essential to figure out a driving style that is acceptable in the future, something that will not offend the other passengers and guarantees the optimal performance and comfort required indirectly for the passenger inside the vehicles. Previous literature found that discomfort from various sources is concurrently revealed in drivers' behavior during driving activities such as acceleration, deceleration, and taking corners [6]. Another area of psychology in human factors also concretized the need to be studied in driving style, which involves applying knowledge of human traits to increase the level of acceptance inside the moving vehicle based on the self-assessment questionnaire [7]. A self-assessment questionnaire is a straightforward approach to identifying the type of drivers because of its effectiveness in administering to a larger group of respondents. The information on someone's self-reported driving style, including sociodemographics, general personality factors, driving-specific skills, attitudes, and behaviors, has been developed and validated in previous literature [8]–[10].

A considerable amount of literature has been published on self-assessment for driving style, such as the Multidimensional Driving Style Inventory, to validate the four domains of driving style [11], The Driver Behavior Questionnaire measures self-reported driving behaviors in the involvement of accidents [12] or The Attitudes to Driving Violations, investigating the personality and attitude predictors of self-reported aggressive driving with collision rates [13]. The Driving Behaviour Inventory studies investigate driving stress, aggression driving alertness, frustration, and overall driving stress in driving [14]. The Driving Style Questionnaire explores decisions that have been associated with accident involvement or risky driving, such as speed, headway (distance to the car in front), seat belt use, gap acceptance (size of the gap in the flow of traffic before attempting to pull out), and traffic light violations directly connected to driving

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decision-making, such as feelings of control, route planning, and risk-taking on the road [15]. Another self-assessment was the Driving Vengeance Questionnaire developed to evaluate drivers' use of retaliation in everyday driving scenarios, such as when dealing with violent or nonviolent offenders, according to the level of action used to commit the offence [16]. Although all questionnaires were mentioned in the previous literature as a tool to assess the driving style, the method was criticized due to their weakness in collecting reliable data and unbiased information about driving behavior [17]. As mentioned in the study by Gutzwiller et al., the weakness of the questionnaire data is due to the social desirability bias, recall bias, limited scope, and lack of objectivity [17].

The concept of investigating the driving style of the driver has been challenged by past researchers, [2], [4], [9], and [10], who have evaluated driver behavior in real road or simulator studies. The studies examine the relationship between drivers' perceptions of their driving skills and compare them with the expert evaluation of the driving experiment. For example, the simulator studies found a medium correlation between the driving behavior collected from the questionnaire data score and the expert evaluation [18]. In contrast, [19] found a low to medium correlation between the driver and expert evaluation regarding average corridor-level travel time, acceleration and deceleration characteristics, and the number of lane changes in the driving simulator studies. Another example from [2] studied how self-reported behavior correlated with behavior reported by a designated observer sitting beside the participants in the car. Their findings showed that self-reported speed might be used to substitute direct speed observations. A study found low to moderate correlations between driver and observer judgments of driving abilities and behavior, focusing on speed and traffic light mistakes and infractions [9]. The finding concludes that the combination of self-assessment questionnaires collected from the observer and the driver can be reproduced when most previous studies illustrated an over-positive evaluation. Although there are different outcomes between simulators and real road studies, as the literature proves, a comprehensive evaluation of driving style may be adequate to conceptualize or validate measurement tools to reproduce in the Malaysian region to reveal the Malaysian driving style.

However, those results are from the literature on data from over ten years ago. It is still being determined if the findings of recent literature on the questionnaire on driving skills can be addressed regarding the current situation regarding driving style, especially for Malaysian drivers. Moreover, research on the participant has been restricted due to limitations in comparisons for Malaysian drivers, especially in validating the self-assessment driving style. The assessment questionnaires have a limited ability to collect contextual data, such as a narrow range of selection criteria for the participant. Respondents may evaluate their driving style using characteristic self-serving definitions when they measure driving behavior and skill in broad and complex domains. Due to sensitivity issues in self-assessment research and the assessment of overall driving proficiency, a study emphasized the technique while validating the driving style. Drivers may be prompted to assess their complicated skills when given an imprecise and imprecise comparison [9]. This lack of detail must be addressed to enhance drivers' self-evaluations. An alternative approach suggested comparing the desired behavior to the driving performance [18]. The explanation is that when employing different methodological techniques, such as comparing actual performance in on-road driving or simulator activities, the question of whether drivers overestimate themselves is solved in a particular study by [20].

Self-assessment questionnaire bias still exists since many drivers gave themselves higher ratings, even though most of this research found modest correlations between expert and subjective assessments on actual road research studies [18]. The study set out to evaluate drivers' self-perceptions of their driving skills and conduct expert evaluations of their driving, inspired by current work's limits from previous literature. The present study included driver and observer evaluations based on task performance to address the potential for questionnaire bias. Hence the study was set to explore the Malaysian driving style using self-assessment [21]. The precision of the rating scale was compared with the participant and designated observer's answers during driving activities with actual task activities during the on-road driving session. The study's goal was to contribute to the subsequent continuing studies by giving more objective measures of the target skills and performances for this study. Furthermore, the assessment process's improvement has been considered by using a more specific, well-organized structure from the questionnaires with items focusing on the aspects of driving. In addition, the driver drove the exact instrumented vehicle while completing the driving experiment in actual road conditions to imitate the real situation and environment.

In this study, the participants performed the actual task-driving activities with the evaluated their own driving behavior and expert evaluation. The objective of this study was to compare whether there is any difference between self-assessment before and after driving activities. The total score collected from the self-assessment task response from both participant and observer was analyzed in SPSS. The questionnaire consisted of two different types to evaluate driving behavior. For the first questionnaire, eight (8) dimensions and 25 items indicate the error/violation of participants during driving in varied road situations and environments. The questionnaire was initially constructed based on previous research and evaluated by the participant after the driving session and evaluated by the observer during the driving session [9], [22], [23]. Second, a Driver Evaluation Questionnaire (DEQ) is a form to rate the overall participant's performance. This form consisted of 18 items to evaluate the driving performance when participants were driving the instrumented vehicle on a designated route regarding driving style, behavior, and abilities. The questionnaire was assessed using the same method and was initially constructed based on previous research [9], [24].

Due to the use of a specific actual driving session and strong correspondence across measures, there are expected to be substantial correlations between self-assessments and expert evaluations of driving abilities when conducted in the

current study. However, since there is no feedback provided during the driving sessions, it is expected that a substantial low correlation was found. The driver was expected to drive as usual they drive on the road. Therefore, from the initial study hypothesis, self-evaluations of driving self-rating would be greater than designated observer rating scale evaluations. Moreover, general driving behavior is rated higher than the individual observer. Consistent with current literature, it hypothesized that most drivers would overestimate their driving ability and skills.

2.0 METHODOLOGY

2.1 Procedure

The questionnaire was blasted through posters and social media in the community of Universiti Tun Hussein Onn Malaysia (UTHM), Pagoh, Johor, Malaysia. The questionnaire was split up into several experimental questionnaires such as general information (e.g., "Can you drive a manual car?"), the demographic question such as (e.g., "What is your driving history in years?", "How long have you had a driving license?") and contact information. The selected participant is invited using a phone call to answer another form for the booking time slot. Upon arrival at the designated location for the experiment, the participant was briefed by the first observer about the experiment's flow, rules, and tasks. Then, they were escorted to the instrumented vehicle, and each participant was given another informed consent. A second designated observer waited in the instrumented vehicle's back seat. The observers are Malaysian drivers who have been driving on the Malaysia road for at least five (5) years with at least 50 000 km of driving range per year.

Then the participant was briefed with second information about the route and direction, and instructed on how to drive the instrumented vehicle (see Figure 1). One of the observers gave the route direction while the other remained silent and completed his evaluation task toward the driver using on-road observation forms and a driver evaluation questionnaire (DEQ) during the driving session. For the first 5 minutes of the driving session, the participant started the experiment with the Familiarize phase to adapt to the instrumented vehicle and understand how the observer instructed the direction. After the participant completed the familiarization phase, the participant was asked if they were ready to continue the experiment. If not, there were given another trial to attempt until there were prepared to start the next phase. Then another 25 minutes is an experimental phase for the participant to drive the vehicle. At the end of the experiment session, the observer escorted the participant to the evaluation room for the assessment task. The final phase is the questionnaire phase, where the participant gives their rating scale for their driving behavior. During the experiment phase, the evaluation form consisted of two forms: on-road driving observation and driver self-evaluation questionnaire (DSEQ). RM 30 Malaysia was given to the participant who fully completed this experiment. The flow of this study is simplified, as shown in Figure 2.

Figure 1. The instrumented vehicle used in this experiment

2.2 Designated Route

The participants performed driving sessions under two routes: the familiarization route in Figure 3 (a) and the experiment route in Figure 3 (b). The experiment started with a familiarization session to explain the experiment's purpose. During the familiarization route, the navigation consisted of the one-round bout, eight-time cornering, and seven straight-line with an estimated 5 minutes. During this session, the participant could ask questions and clarify doubts about the experiment. Then they continued to the experiment route. The participant went through the course for an estimated 25 minutes consisting of two location pedestrians, two roundabouts, 22 times cornering, and 13 straight lines to imitate the typical suburban roads in Malaysia. During the experiment session, every participant was instructed to repeat the driving experiment another two times, following the same route as before. The objective was to increase data collection for reliability and accuracy [25]. The total distance covered in both phases was approximately 15 km, including 3 km in the familiarization phase and 12 km in the experiment phase.

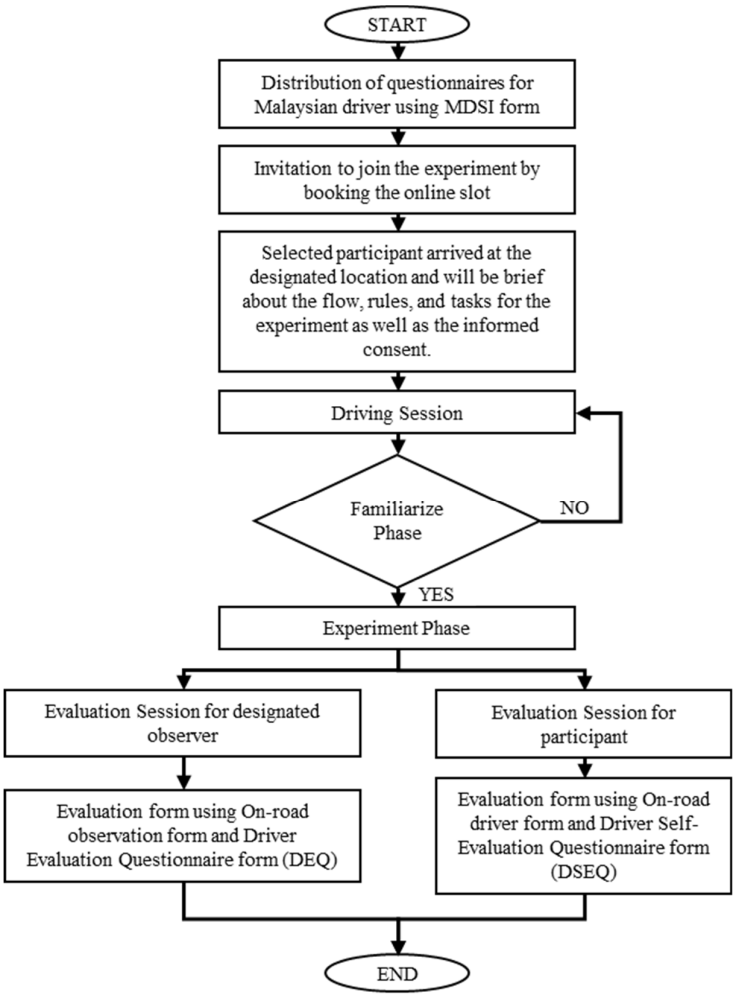

Figure 2. A structural schematic diagram for validation of Malaysian driving

(a) (b)

Figure 3. Routes for (a) familiarization phase and (b) experiment phase

2.3 Participant

The participants consisted of 20 drivers (65% male and 35% female) from the student of Universiti Tun Hussein Onn Malaysia (UTHM). Their age ranged from 20 to 25 years (M = 22.45, SD = 1.39). They held valid driver's licenses ranging from 2 to 8 years (M = 5, SD = 1.65). Based on the years of driving license, the participants were classified into novice drivers (less than three years), consisting of 5%; moderate drivers (between 3 to 7 years), consisting of 85%; and experienced drivers (more than seven years) consisted of 10%. For the driving history, the driver has at least 5000 km per year and a maximum of 100 000 km per year (M = 21.18, SD = 21.91). For the type of vehicle they usually drive, (1)

small size vehicles consisting of 25%, (2) medium size vehicles consisting of 60%, and (3) larger size vehicles consisting of 10%.

2.4 Measurements

On-road driving observation is about driving behavior and consists of eight dimensions with a total of 35 items to indicate the error/violation of participants during driving in varied road situations and environments. The questionnaire was initially constructed based on previous research [9], [22], [23]. However, some of the items in the questionnaire were modified and removed to fit with the objective and designated route (university route) based on the situation of Malaysian drivers. The final 24 items were used in the on-road observation form to rate the participant during the driving and evaluation session. The item consisted of seven factors; speed errors/violations (4 items), lane and passing errors/violations (6 items), road sign errors/violations (3 items), intersection usage errors/violations (3 items), errors/violations against pedestrian and cycler (1 item), clearance and checking errors/violations (4 items), and brake and brake/gear errors/violations (3 items). The assessment was completed by only one designated observer during the experiment phase in terms of a 5-point Likert scale ("1" never, "5" very frequently) when the participant was driving the instrumented vehicle and during the evaluation phase for the participant evaluation. The observer reported their observations on the form while driving on the different road segments at least two times or more in each road segment. The analysis, including the Principle Component Analysis, reliability, and correlation test for each dimension, was done in SPSS version 26.0.

A driver evaluation questionnaire (DEQ) consists of 18 items to evaluate the driving performance when participants were driving the instrumented vehicle on a designated route regarding driving style, driving behavior, and abilities. The questionnaire was initially constructed based on previous research [9], [24]. However, some of the items in the questionnaire were modified to fit the objective and designated route. For example, item number 2 was changed from the initial meaning "perceiving hazards in traffic" to "perceiving hazards in the intersection" to adapt to the study's objective with the designated route where the location was completed in the university area. The driver self-evaluation questionnaire (DSEQ) was identical to the "Driver evaluation questionnaire (DEQ)." Still, the difference is that DEQ is evaluated by the observer when the participant is driving the instrumented vehicle. At the same time, DSEQ is completed after the participant finished the experiment during the evaluation phase in terms of a 5-point Likert scale ("1" indicating low, "5" indicating high skill and performance). The observers reported their observations on the form while driving on the different road segments at least two times or more in each road segment. The analysis included the Principal Components Analysis, reliability, analysis of variance (ANOVA), Wilcoxon z value, and Pearson correlation test for each dimension in SPSS version 26.0.

3.0 RESULTS AND DISCUSSION

An error/violation and assessment form matching the responses of 20 participants and two observers was subjected to a main Principal Components Analysis (PCA). The initial error/violation form has seven (7) dimensions (25 items), whereas the driving performance evaluation has 18 items. A loading value of 0.3 was selected as a cutoff analysis for all questions in the questionnaire. According to the scree plot, the data best suited a nine-factor solution. The distribution of 25 items across nine variables explained 59% of the variation with all items loaded (0.30 - 0.95). The observer error/violation questionnaire has a medium internal consistency (Cronbach's alpha = 0.46). According to the scree plot, the data were best suited for an eight-factor solution. The distribution of 25 items over eight variables explained 98% of the variation with all items loaded (0.31 - 0.95). The observer vague/violation questionnaire has strong internal consistency (Cronbach's alpha = 0.78).

With an initial set of 18 items, the driver evaluation questionnaire (DEQ) and driver self-evaluation form (DSEQ) were also subjected to main components analysis. The cutoff criterion for all items analyzed for the DEQ form with loading values was set at 0.3. According to the scree plot, the data were fitted for a ten-factor solution. The distribution of 18 items over ten (10) variables explained 61% of the variation with all items loaded (0.31 - 0.86). The observer error/violation questionnaire has strong internal consistency (Cronbach's alpha = 0.82). The scree plot for the driver self-evaluation questionnaire (DSEQ) suggested that the data were fitted for a six-factor solution. The distribution of 18 items over six categories explained 41% of the variation with all items loaded (0.32 - 0.93). The observer error/violation questionnaire has strong internal consistency (Cronbach's alpha = 0.79). Table 1 displays each questionnaire form's mean, standard deviation, and reliability data.

Table 1. Mean, standard derivation, and reliability statistics for the observer and driver scale form

Scale	Factor (Items)	Cronbach's a	Mean	SD	Variance
On-road observer form	9 (25)	0.46	59.10	7.68	59.04
On-road driver form	8 (25)	0.78	67.05	9.96	98.10
DEQ form	10 (18)	0.82	71.95	7.83	61.31
DSEQ form	6 (18)	0.79	66.50	6.40	41.00

The total mean of the on-road driving session (error/violation for driver form) was compared with the mean of the number of (errors/violations for observer form). The evaluations were to identify if there was a correlation between the

observer's evaluations and self-rated questionnaire responses, as shown in Table 2. The results show no significant correlation between the driver's self-evaluation scores with the observer's evaluations. However, there are positive and low correlation effects for speed, lane and signal, road sign, intersection usage, and brake and gear errors (r = 0.01 through 0.37). Then there is a negative and low correlation for clearance and checking error for the observer and driver violation and errors dimensions. The study was compared to the findings of previous work that found a low to moderate correlation between the observer and driver for the error/violation [9]. A possible explanation for these results may be the lack of adequate for the participant to indicate a factor of perceptions regarding self-unawareness of performance. The limitation was expected from the insufficient experience, fatigue, or age number of the existing participant who had finished this study. In addition, the potential hazards underestimation of task demands, such as traffic complexity environment, might be another reason for the different outcomes for the result to prove for the respondent when answering the self-assessment questionnaire [9], [26].

Table 2. Correlations between drivers' and observers' evaluations for the violations/errors dimensions

Violations/errors	Correlation *(r)*
Speed errors	0.18
Lane and signal errors	0.01
Road sign errors	0.01
Intersection usage errors	0.37
Clearance and checking errors	-0.16
Brake and gear errors	0.24

*P<0.05 * indicates a significant effect*

The study continues to compare the item evaluated by the observer (on-road observation form), as shown in Table 3, and the participant (on-road driver observation form), as shown in Table 4. For correlation between the item in the observer-evaluation form, only three significant correlations were found between the items for observer violation/error categories. There is a low negative correlation and significance between road sign errors and brake and gear errors ($r = -0.23$, $p < 0.05$) and a high negative correlation and very significant between speed error and road sign error ($r = -0.63$, $p < 0.01$). Then there is a high positive correlation and very significant for brake and gear error with the speed error ($r = -0.63$, $p < 0.01$).

Table 3. Correlations for the observer for the violations/error dimensions

Error/violation self-evaluation	Correlation *(r)*					
	Speed errors	Lane and signal errors	Road sign errors	Intersection usage errors	Clearance and checking errors	Brake and gear errors
Speed errors	-	-	-	-	-	-
Lane and signal errors	0.34	-	-	-	-	-
Road sign errors	0.63**	-0.19	-	-	-	-
Intersection usage errors	0.24	0.00	-0.13	-	-	-
Clearance and checking errors	0.21	0.33	-0.17	0.11	-	-
Brake and gear errors	0.78**	0.11	-0.23*	-0.03	-0.03	-

*P<0.05 * indicates a significant effect*
*P<0.01 ** indicates a very significant effect*

Table 4. Correlations for the driver for the violations/error dimensions

Error/violation self-evaluation	Correlation *(r)*					
	Speed errors	Lane and signal errors	Road sign errors	Intersection usage errors	Clearance and checking errors	Brake and gear errors
Speed errors	-	-	-	-	-	-
Lane and signal errors	-0.45*	-	-	-	-	-
Road sign errors	0.19	-0.17	-	-	-	-
Intersection usage errors	0.70**	0.53*	0.03	-	-	-
Clearance and checking errors	0.03	0.09	0.09	-0.14	-	-
Brake and gear errors	0.43	0.33	-0.23	0.46*	-0.30	-

*P<0.05 * indicates a significant effect*
*P<0.01 ** indicates a very significant effect*

The correlations for the driver for violations/error dimensions between the item four significant correlations were found between the items for driver violation/error categories. There is a medium negative correlation and significance between lane and signal errors and speed errors ($r = -0.45$, $p < 0.05$). Medium positive correlation and significance between lane and signal errors with intersection usage errors ($r = 0.53$, $p < 0.05$) and a correlation between intersection usage errors and brake and gear errors ($r = 0.46$, $p < 0.01$). Lastly, there is a high positive correlation and very significant for speed and intersection usage errors ($r = 0.70$, $p < 0.01$). However, this result has not previously been described based on the previous literature, such as completed from the study [9]. Hence, the data shown in Tables 3 and 4 is the novelty

of this study and for the other researcher to continue the study to see the correlation in error/violation for the observer and the participant.

Furthermore, another motivation for the study was to seek the possibilities of the driver self-evaluate as better than observer evaluation based on evaluation questionnaires from DEQ and DSEQ. Hence the mean difference of 18 matching questions was labeled as "difference scores" after subtracting the observer's rating (DEQ) from the participant's rating (DSEQ) for each item. The difference score was developed to compare drivers' and experts' evaluations. The value zero and more are considered for rating their driving performance higher than the evaluation from the designated observer. While the driver tended to achieve below the zero scores and below, they evaluated their performance as either the same or worse than the observer. From this data, we can see only 5% of the drivers. In comparison, the other 95% appraise themselves over-positively. These results suggest that most drivers evaluated their driving performance better than the observer, as stated in [26]. The most common problem with self-assessment is the driver's tendency to undervalue their actions [26]. For better terminology, "they might declare their work good, while might declare it very good." Moreover, the Wilcoxon test was used to compare each item in the driving evaluation and driving self-evaluation questionnaire, as shown in Table 5. All measures were positive, showing that drivers overestimated their driving performance in all driver abilities and conduct categories. The findings observed in this study mirror those of the previous studies on the drivers' driving style [9]. The result illustrated that most drivers over positively overestimated their driving performance compared to the observer.

Table 5. DEQ and DSEQ items mean and standard deviations, Wilcoxon z values

Items	DEQ		DSEQ		Z
	M	SD	M	SD	
Steering	4.50	0.51	4.00	0.65	-2.67*
Anger toward other drivers	2.30	0.92	2.25	1.11	-0.16
Supportive driving	4.20	1.06	3.60	0.82	-1.57
Anxiety	2.75	1.16	2.00	0.98	-2.31*
Vigilance	4.70	0.47	4.10	0.55	-3.00*
Safety	4.15	0.56	4.30	0.57	-0.78
Fluent driving	4.85	0.37	4.15	0.67	-3.50*
Perceiving hazards in an intersection	4.80	0.41	4.10	0.91	-2.83*
Careful towards other road users	4.65	0.59	4.35	0.50	-1.90*
Driving behind a car without being impatient	3.25	1.21	2.55	1.05	-2.00*
Predicting traffic situations ahead	4.25	0.64	4.00	0.56	-1.39
Fluent lane changes	4.25	0.72	4.00	0.46	-1.29
Adjusting speed	4.25	0.85	4.05	0.51	-7.33
Signal	4.70	0.73	4.10	0.64	-3.00*
Relinquishing legitimate rights when necessary	4.55	0.51	3.55	0.83	-3.47*
Avoiding risk	4.25	0.97	4.20	0.62	-0.50
Conforming to speed limits	2.85	1.57	3.30	0.87	-1.25
Obeying traffic lights	2.70	1.38	3.90	0.85	-2.84*

*P<0.05 *indicates significant effect*

The possibility of difference for evaluation of driving performance DEQ and DSEQ form was expected from the difference in demographic data. Hence univariate analyses of variance (ANOVA) were performed to explore the significant mean difference between demographic data with DEQ and DSEQ. The mean scores were compared using repeated measures ANOVA with gender, age, driving license, driving experience, and expected each year kilometers as variables (see Table 6). The results show that most demographic data were higher on participant self-evaluation than the observer. The ANOVA found significant differences in four over five demographic data for driver evaluation compared to the observer. The significant difference is between gender, age, driving license, and driving experience. It is interesting to note that covariates are very significant for gender ($F(1,18) = 3.681$ $p < 0.01$), significant for age ($F(5,14) = 4.041$ $p < 0.05$), significant for driving license (years) ($F(6,13) = 2.389$ $p < 0.05$) and significant on driving experienced ($F(2,17) = 6.953$ $p < 0.05$) about the variation between DEQ and DSEQ. Drivers' self-assessments were higher than the expert's, showing they rated their driving as better and more robust than the observer. The current study's findings are consistent with those of [4], who show the result for the gender difference. Contrary to expectations, this further studies by analyzing other demographic data, and surprisingly there are also significant in the data as stated.

Table 6. DEQ and DSEQ for the ANOVA test

		Population	DEQ			DSEQ		
		size, N	Mean	SD	ANOVA	Mean	SD	ANOVA
Gender	Male	13	4.11	0.47	F (1,18) = 2.575	3.80	0.37	F (1,18) = 3.681
	Female	7	3.79	0.30	p=0.126	3.50	0.25	p=0.071**
Age	20	2	3.70	0.67	F (5,14) = 1.075	4.20	0.67	F (5,14) = 4.041
(year old)	21	2	3.94	0.00	p=0.416	3.78	0.78	p=0.018*
	22	8	4.23	0.45		3.70	0.22	
	23	2	3.73	0.47		3.40	0.00	
	24	5	3.82	0.36		3.44	0.22	
	25	1	4.28	0.00		4.33	0.00	
Driving	< 2	1	4.17	0.00	F (6,13) = 0.412	4.67	0.00	F (6,13) = 2.389
license	< 3	3	3.76	0.47	p=0.858	3.67	0.55	p=0.089*
(years)	< 4	4	3.93	0.74		3.76	0.30	
	< 5	4	4.22	0.41		3.57	0.30	
	< 6	5	3.90	0.33		3.50	0.16	
	< 7	1	3.94	0.00		3.72	0.00	
	< 8	2	4.23	0.78		3.83	0.71	
Driving	Novice	1	4.17	0.00	F (2,17) = 0.392	4.67	0.00	F (2,17) = 6.953
experience	driver				p=0.682			p=0.006*
	Moderate driver	17	3.96	0.46		3.62	0.23	
	Experience driver	2	4.23	0.08		3.83	0.71	
Annual	Rarely	5	4.07	0.48	F (1,18) = 0.121	3.68	0.56	F (1,18) = 0.011
mileage	drive				p=0.732			p=0.919
	Daily drive	15	3.98	0.44		3.70	0.29	

*P<0.01 *indicates a significant effect*

4.0 CONCLUSIONS

The result explains the different outcomes between the driver and the expert evaluation due to the difference in gender, age, own driving license, and driving experience for each driver because most of the participants overestimated their driving behavior compared to the expert evaluation. Overall, self-assessment is an essential tool that might have a crucial role in increasing the probability of driving preference, especially for the near future, such as an automated vehicle. For example, the driving preference of the future user can be recognized to accelerate the acceptance inside the automated vehicle. The driving style may be adapted to the user's preferences. In addition, incorporating on-road driving and feedback sessions into driver training and rehabilitation program may result in a more realistic perception of driving behavior. This is because professionals seldom evaluate driving abilities and habits the license to drive is obtained. Most data on driving skills are based on drivers' self-evaluations of their performance, which is crucial in traffic safety. study into self-driving capabilities looks to be a promising study area deserving of further consideration for road safety from this standpoint. The result indicated that the self-assessment experiment was based on objective, purpose, and unbiased result correspondence to validate the Malaysian driving style/behavior. First, a set questionnaire ranging from acceptable to good explained that the questionnaire was reliable and consistently aligned with this study's objective. Second, the Pearson correlation analysis seeks the correlation between the driver and expert rating score for the driving style. However, the result explains no correlations between observation and self-rating evaluation. The result concludes that the respondent should have answered the questionnaire based on the situation compared to the responses from self-assessment data before and during the driving activities. It indicates the different perceptions between observer and driver in limitations, such as low self-unawareness, lack of sufficient experience, and underestimation of task demands. In addition, the experiment was conducted on the university route, causing environmental complexity for each participant to adapt to the situation in real road conditions.

There is a relationship between each item for the driver and observer evaluation and the significant difference for the items. Besides, from the evaluation result, most self-assessments were higher if the driving performance was evaluated independently compared to the observer. Lastly, the ANOVA was conducted to seek the significant difference between the mean data collected for the sociodemographic data. The result explains that the different outcome between the driver and the expert evaluation is due to the different gender, age, own driving license, and driving experience of each driver due to the participants overestimating their driving behavior compared to the expert evaluation. Overall, self-assessment is an essential tool that might have a crucial role in increasing the probability of driving preference, especially for the near future, such as an automated vehicle. For example, the future user's driving preference can be recognized to accelerate the acceptance inside the automated vehicle. The type of driving style can be tuned according to the user's preference. Implementing on-road driving and feedback sessions during training and driver rehabilitation programs may result in a more realistic self-perception of driving behavior. The reason is that experts must evaluate driving skills and behaviors

after obtaining a driver's license. Most information about driving competence is based on drivers' self-evaluations of their performance, which is critical in traffic safety. From this vantage point, research into self-driving capability is a promising research topic worthy of further investigation for road safety.

This study's results are subject to at least three constraints. To begin, a possible disadvantage of this research is that drivers were observed in a designated instrumented vehicle with a manual transmission. Being seen while driving on the road may induce individuals to drive more cautiously and avoid harmful behaviors, casting doubt on the assumption of naturalistic observation. Although several steps had been made to reduce the risk of bias, such as reminding the drivers that the on-road session they were engaging in was not a testing session and that we wanted them to drive as they always did, biases were still present. Nonetheless, several respondents reported that the presence of the designated experimenter seemed to impact their driving conduct. As previously proved in the literature, observer bias may have still been effective. Second, due to practical constraints, this paper cannot provide a comprehensive review of the current study to define in the context validation of the Malaysian driving style because only 20 participant was able to use as a participant to collect the data. Hence, the following study can be improved by increasing the total number of participants to analyze these variables. Lastly, the scope of this study was limited in terms of the fixed environment during the experiments because of the diversity of weather in Malaysia. This is because the study was completed in real road studies. However, some precautions have been taken to increase the effectiveness of the study, such as fixing the time to start during the experiment (9 am- 4 pm) and stopping the experiment when rainy days. From this condition, the experimenter decides to continue to run the experiment when the visibility and roads are in excellent condition.

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