

# **ROAD SAFETY AND TRAFFIC INJURIES DUE TO DISTRACTED DRIVING OF SMARTPHONE USAGE AMONG UNIVERSITY STUDENTS**

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**Abstract** — This study provides the behaviour of university students using smartphone on daily basis and while driving, and exploring their perception towards the road safety of such habits. World Health Organisation states that distracted driving due to smartphone usage has been the uprising cause of road traffic injuries especially among young drivers. This study will provide knowledge in enforcing the right mitigation measures in preventing such behaviour from growing. The results from this study can also be integrated in intelligent transportation system in traffic accident prevention programme. This survey is conducted at Universiti Tun Hussein Onn Malaysia with a sample size of 371 respondents with majority of them aged 21 to 25 (86.6%) who own smartphone (100%) and private vehicle (59.1%). Results found that university student are dependent of their smartphone on daily basis for alarm (94.3%), communication and socialisation (73.9%). They tend to use their smartphone while driving, at traffic light (68.4%) and during traffic congestion (61.0%), often for maps navigations (69.8%) and to make call (57.4%) in hands-free mode. Despite knowing the danger of this behaviour (97.3%), they ignored the risks and committed such offenses. Hence, the need for education and enforcement are significant and relevant among university students to prevent such behaviours from growing.

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**Keywords:** Smartphone, Driving, University Students, Road Traffic Accidents

## **1.0 INTRODUCTION**

World Health Organisation [1] recently published an article on the cause of road traffic injuries involved young generation aged 5 to 29 years old with young males ages 25 years old more likely to be killed in road traffic crash than young females. One of the main reasons being distracted driving due to phone usage that impaired drivers' reaction time. While, in Malaysia, traffic accidents keep increasing each year involving car, motorcycle, van, and others leading to fatality. In 2018, 548.598 total number of accidents involved, 6284 were fatality. One of the main factors that can contribute to traffic accidents is by human factor such as distracted driving [2]. This behaviour refers to the loss of control while driving that are caused by doing any activities that can be affected on driver's attention not focusing on the road. Texting and other phone use while driving has emerged as a major contribution to teenage and young adult injury and death in motor vehicle collisions over the past several years [3]. Therefore, this study investigates smartphone usage behaviour among university students to understand this implication among Malaysian youths with the following objectives: to identify smartphone and private vehicle ownership among university students; to identify their behaviours of smartphone usage; and their usage habits while driving; lastly, to identify their safety and risk perception on these behaviours.

## **2.0 LITERATURE REVIEW**

### **2.1. ROAD TRAFFIC ACCIDENTS**

Road Traffic Accidents (RTAs) occur when collision between vehicle with another vehicles (car, bus, motorcycle), livings (tree, animal, pedestrian) and objects (property, building, road furniture) that resulted in damage, injury and fatality. The three main contributing factors to RTAs are human, environment and vehicle [4]. The biggest

contributor is human factor includes speeding [5], negligence of safety features [6], [7], distracted driving, aggressive driving [8]. Environment factor includes unsafe road infrastructure, inadequate law enforcement. Vehicles factor includes faulty parts, no maintenance. To overcome this global health problem, Ministry of Transportation Malaysia had come up with various initiatives that included these five elements, education, enforcement, engineering, environmental and evaluation.

Distracted driving is one of the main human factors that resulted in RTAs. Driving is a daily activity that requires active coordination of the eye, hand and foot. Distractions to visual, auditory, manual and cognitive increases the potential risk to RTAs. Multitasking or doing two things at once decreases drivers' performance and concentration divert their attention and ability to recognise potential road hazards contributes to RTAs. Distraction includes eating and drinking, adjusting audio, dialling and messaging, conversation on phone while driving [9]. Among the type of distractions, phone usage is a growing concern especially among youths as seen with road traffic injuries being the leading cause of death for youths. Drivers using phone expose themselves to approximately 4 times the risk of RTAs than drivers not using phone [1].

The act of using phones while driving is illegal, but this did not stop drivers from committing such offences [10]. Intelligent transportation system has then gained the limelight in the visual control of drivers behaviour on the road to detect motion of said offences in order to issue merit tickets to offenders. This is widely done in developed countries using artificial intelligence to detect drivers using phones behind the wheel. This involves pattern recognition of how the phones being use such as being captured with phones to their ears or both hands clearly not the steering wheel but using their phones in their laps or one hand on the steering wheel while the other hand on the phone. Hence, by introducing this proposed intelligent transportation system could have prevent more fatal and serios injury accidents in future [11].

## 2.2. SMARTPHONE USAGE BEHAVIORS AMONG YOUTHS

Phone is a telecommunication tool that connects individuals. Phone has evolved from simple calling and texting of mobile phone to the current smartphone with advance ability to internet access. Some of the common behaviours of smartphone usage among youths include texting and messaging; dialling, calling and answering; reading, viewing and browsing social media; maps navigation; video and audio recording; photo; music and gaming either by hand-held or hands-free mode [12]. Smartphone has become affordable and with increase financial stability and quality of life with economic prosperity, youths nowadays could own one for improved communication and socialisation [13]. Inadvertently, the usage of smartphone has become a compulsory and necessity for education and entertainment. The convenient and compact features in one small device, unknowingly they become addictive to their smartphones. The common sight to this aberrant behaviour of using smartphone while driving among youths despite the risk to RTAs [14]. Youths including university students find themselves constantly on their smartphone to meet the demands of their hectic schedules, trending influences and life needs.

Various self-reported survey studies found that university students tend to ignore the danger or violate the law to use their smartphone due addiction [15], experience, age, gender and intentions [16], awareness [17]. Some studies used monitoring devices found that youths frequently touching their smartphone because of their mindfulness [18] and personality [19]. Intense usage of smartphone not only affects drivers, motorcyclist [20] as well as pedestrians [15] are vulnerable due to impartments and inability to maintain moving direction.

## 2.3. STATISTICAL TEST AND INTERPRETATION

Pilot test is important to examine the feasibility of methods used to increase the likelihood of success in a subsequent larger and more comprehensive investigation. The test will show the early estimation of the results to locate any bias responses so that the questionnaire can be used for the study. The quantity of respondents for pilot test can be 10% to 20% of sample size, N [21].

Cronbach's Alpha reliability test is a measure of internal consistency of a test or a scale in a decimal number of 0 to 1. Internal consistency is a description of how far the parameters in the test measures a consistent concept to one another so that result obtained later is reliable [22]. According to [23], 0.7 is the standard alpha value. Some support other than 0.7, [24] suggested between 0.6 to 0.7 is already acceptable for Cronbach's alpha.

Pearson's correlation test is the strength measurement of a linear association between two groups [25]. Pearson's correlation coefficient,  $r$ , can range from +1 to -1 with 0 indicating no association between two groups. Closer to  $\pm 1$  for large,  $\pm 0.5$  for medium and  $\pm 0.3$  for small strength of association. Negative association or less than 0 indicates that the value of one variable increases, the other decreases. While, positive association or more than 0 indicates that the values of one variable increases, the other increases.

Cochran's Q is used to test more than 2 set of groups with binary response (e.g 0 or 1) with null hypothesis that that proportion is the same between groups versus the alternative that the proportion is different in at least one of the groups. If the statistical significance value is less than 0.05, the results are significantly different. Alternatively, if the statistical significance value is more than 0.05, the results are not significantly different and the proportion is the same across the groups [26].

### **3.0 METHODOLOGY**

#### **3.1. RESEARCH DESIGN**

Location of study is at main campus of University Tun Hussein Onn Malaysia, Batu Pahat, Johor with a population of 12186 university students and a female to male ratio of 7:3 in the civil engineering department. A sample size of 370 respondents is sufficient based on Krejcie & Morgan table [27]. Pilot test is conducted prior to actual questionnaire distribution. For pilot study, 10% of sample size or total of 37 respondents is sufficient. 40 students participated in pilot test. Upon passing reliability test, this study collected 371 participants by random self-selection sampling.

Questionnaire is distributed via online platform of google form. Data collection is self-administrated whereby respondents remain anonymous. Data collected is analysed using Statistical Package for the Social Sciences (SPSS) 21 software for reliability test to obtain Cronbach's Alpha value; total and percentage on section analysis; and correlation test. The questionnaire consists of 30 questions with 4 sections: A on demographic characteristics (multiple choices); Following sections are closed-ended statements (true or false choices), B on respondents' experience with smartphone usage while driving; C on respondents' behaviour with smartphone usage while driving; and D on safety perceptions.

#### **3.2. INSTRUMENTATION AND MEASUREMENT**

The questionnaire is created based on several similar previous studies conducted regarding this topic of smartphone usage while driving. All questions are selected to achieve the research objectives. The descriptions for the 4 sections are determined below.

- Section A This section covers respondents' demographic characteristics including age, gender, mode of transport and smartphone ownership.
- Section B This section covers respondents' experiences on road traffic accidents and distracted driving due to smartphones.
- Section C This section identifies respondents' behaviours on smartphone usage in their a) daily life and b) while driving.
- Section D This section identifies respondent's perception towards safety of using smartphone while driving, the human factor and environment factor.

### **4.0 RESULTS AND DISCUSSIONS**

Pilot test revealed Cronbach's Alpha value about 0.6. Even though is acceptable, amendments are made by deleting a few unnecessary questions to gain a higher reliability result. The amended questionnaire was spread again among UTHM students. The final survey had a new Cronbach's Alpha value as shown in Table 1. After collecting more than 370 respondents and successfully passing reliability test, filtration was carried out to avoid processing incomplete questionnaire. A total of 371 responses are proceed for analysis with a reliability result of 0.78 Cronbach's Alpha value.

**Table 1** Reliability Statistics

<b>Cronbach's Alpha</b>	<b>Cronbach's Alpha Based on Standardized Items</b>	<b>N of Items</b>
0.735	0.788	30

#### 4.1. DEMOGRAPHIC ANALYSIS

The total of 371 UTHM university students from the civil engineering department participated in this research, 63.1% of respondents were females and 36.9% were male students which reflects the true female to male ratio of 7:3 of the department. As shown in Table 2, majority of them aged 21 to 25 years old (86.8%) who are in their undergraduate studies. They also are new drivers with (60.9%) less than 5 years of driving experiences, mainly travel by car (32.4%). While, 2.1% with more 10 years driving experience are students with motorcycle (26.7%). All of them possessed smartphone because of current necessity for academic purposes and communication.

Those who own smartphones and private vehicles have strong attachment to distracted driving and smartphone addiction. Masuri et al. [14] reported that young drivers who had their own car are comfortable to unsafe driving and high tendency to develop the behaviour of using their smartphone for social media while driving.

**Table 2** Demographic Characteristics

<b>Demographic Characteristics</b>	<b>Total</b>	<b>Percent, %</b>
<b>Gender (participants)</b>		
Female	234	63.1
Male	137	36.9
<b>Age (years)</b>		
16 – 20	22	5.9
21 – 25	322	86.8
26 – 30	27	7.3
<b>Driving Experience (years)</b>		
< 5	226	60.9
5 – 10	137	36.9
10 – 15	8	2.1
<b>Mode of Transport (participants)</b>		
Car	120	32.4
Motorcycle	99	26.7
Carpool	36	9.7
Pedestrian	55	14.8
Bicycle	10	2.7
Bus	51	13.7
<b>Smartphone Ownership (participants)</b>		
Yes	371	100

#### 4.2. ROAD TRAFFIC ACCIDENT EXPERIENCES

Illustrated in Table 3, this research identified that more than half of the participants (56.6%) experience road traffic accidents due to distracted driving, occurrences either caused by them or due to others. 59.3% of them admitted they are distracted due to using smartphone while driving. Besides, the use of smartphone while driving in the campus is a common sight with 91.6% of respondents seen drivers or motorcyclists using smartphone while driving. 94.9% respondents agreed that this act of multitasking is a distraction when the concentration for driving is diverted with smartphone usage. For them (95.2%), smartphone can be addictive, they find it hard to resist the urge to check

their smartphone while driving. Kim et al. [15] found that university students who are addicted to their smartphone have greater experience to RTAs. Thruong et al. [20] found that 40% of motorcyclist reported to have experienced RTAs and 24% sustained injuries, with 5% of them reported happened when they were using phone for calling:

**Table 3** Road Traffic Accident Experiences

<b>Section B: Respondents' Experiences</b>	<b>Total</b>	<b>%</b>
Have you involved in road traffic accidents due to distracted driving?	210	56.6
Have you use smartphone while driving?	220	59.3
Have you seen drivers or motorcyclists using smartphone while driving in campus?	340	91.6
Is doing two things simultaneously distracts concentration while driving?	352	94.9
Smartphone usage can be addictive?	353	95.2

### 4.3. SMARTPHONE USAGE BEHAVIOURS

Shown in Table 4, on the daily basis, smartphone usage by respondents mainly for (94.3%) alarm setting and (73.9%) check notifications first thing after waking up for updates either for WhatsApp, Facebook, Instagram, generally to check education tasks for the day, followed by personal matters. 77.1% of respondents have the habit to check whether they bring along their smartphone before leaving home and 63.1% of respondents feel uncomfortable if they forget to bring along their smartphone. Only 29.7% of them willing to skip class to take their smartphone that they have forgotten.

**Table 4** Daily Smartphone Usage

<b>Section C a): Daily Life</b>	<b>Total</b>	<b>%</b>
Do you set alarm using smartphone?	350	94.3
Do you check all the notifications first thing after waking up?	274	73.9
Do you check the smartphone before leaving home?	286	77.1
Do you feel uncomfortable if you do not have smartphone?	234	63.1
Will you go back to take smartphone and skip class?	110	29.7

While driving, majority of them tend to use their smartphone during traffic congestion (68.4%) and at traffic light (61.0%), hands-free is common too with 55.0% of them used this mode. Fortunately, only 33.2% of them could not resist the need to take smartphone from their bag. In terms of smartphone usages, 72.5% of them will check when their smartphone rings, 69.8% them use for maps navigation, 57.4% of them will receive or make call, 32.1% of them will reply to short messages, 11.3% of them will surf their social media as shown in Table 5.

**Table 5** Smartphone Usage While Driving

<b>Section C b): While Driving</b>	<b>Total</b>	<b>%</b>
I will use smartphone when in traffic congestion	254	68.4
I will use smartphone when at traffic light	226	61.0
I will use hands-free	204	55.0
I will reach my bag to take smartphone	123	33.2
I will use smartphone when it rings	269	72.5
I will use maps navigation	259	69.8
I will receive or make call	213	57.4
I will reply short message like SMS/WhatsApp	119	32.1
I will surf social media like Facebook/ Instagram	42	11.3

Similar observations were reported by Bergmark et al. [28], young adults most likely to write and read text messages (59.2%) while driving, at stop or low speeds with some said to commit such act while travelling at any

speed. The study also found maps were used on the phone (74.6%) while driving. Young drivers touch their smartphones at 1.7 times per minute leaving their hands off the steering wheel while driving, which is relatable to smartphone addictions [19]. They who spend most time on smartphones prone to show addictive behaviours, they unintentionally absorbed into their phone, losing focus on things happening around them. They were found to be addicted to social media such as Facebook and Instagram, applications that they use while driving.

Due to uneven ratio of female to male, analysis by gender on smartphone usage behaviours is tabulated with percentage of agreed answer per total answer by gender. Based on relative differences between female to male from Table 6, female tend to feel uncomfortable than male when they do not have their smartphone with them (9.8%), hence they will make sure to have their smartphone before leaving home (7.6). While, male is relatively more confident than female to receive or make call while driving (9.6%). However, there is no significant difference between gender in most smartphone usage behaviours, regardless of gender, they behave almost the same in their smartphone usage. These findings are similar to [18], [29], female tend to use their smartphone for social purposes, while male consumers opt for practical use to obtain information and make calls. Although females use their smartphones more than males while driving, males are found to be confident to take more risks when driving, there is no significant difference due to the cancelling effect of gender factor in smartphone usage.

**Table 6** Smartphone Usage Behaviours by Gender

Statement from Section C	%	
	Female	Male
I will use smartphone during traffic congestion	69.7	67.2
I will use smartphone at traffic light	63.3	57.7
Set alarm on smartphone	96.2	91.2
Check notifications after waking up	74.4	73.0
Make sure smartphone before leaving home	79.9	72.3
feel uncomfortable if you do not have smartphone	66.7	56.9
Using maps navigation while driving	68.7	71.5
Receive/make call while driving	53.9	63.5
Use hands-free while driving	56.4	52.6
Use smartphone when it rings	72.2	73.0

Pearson's correlation results analysis shows that there is small relationship between smartphone usages with the respondents' age and driving experience where Pearson's correlation value is between 0.1 to 0.3. Results from Table 7 found that there are relationships with significant correlation between age and making sure present of smartphone ( $r=0.15$ ,  $p<0.05$ ); between age and user of smartphone when it rings ( $r=0.223$ ,  $p<0.05$ ); and between using hands-free while driving with driving experience ( $r=0.217$ ,  $p<0.01$ ). Though there is a positive relationship between driving experience and ensuring have smartphone before leaving home ( $r=0.244$ ), there is inconclusive evidence about the significance of the association ( $p>0.05$ ). Those experienced young drivers are more likely to commit road or traffic offenses as they perceived to have high ability and skill to manoeuvre their vehicles due to their high level of self-confidence [14]. Young drivers also are the age group with highest tendency to use their smartphones while driving that will impairs their driving performance [30].

**Table 7** Pearson's Correlation Between Smartphone Usages with Age and Driving Experience

Smartphone Usages/ Demography	Age	Driving Experience
Set alarm on smartphone	-.079	-.098
Check notifications	-.065	.120
Make sure smartphone before leaving home	.150*	.244
feel uncomfortable if you do not have smartphone	.164	.122
Using maps navigation while driving	.024	.087
Receive/make call while driving	-.062	-.096
Use hands-free while driving	-.004	.217**
Use smartphone when it rings	.223*	-.092

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

Cochran's Q analysis from pairing the different smartphone usage behaviours as shown in Table 8 found that those who frequently check their smartphone notifications tend to ensure they have their smartphone before leaving their home ( $P=0.3017$ ,  $P>0.05$ ), but they do not feel uncomfortable when they do not have their smartphone with them ( $P=0$ ,  $P<0.05$ ). While driving, those who use hands-free mode when they receive or make call either by loud-speaker or Bluetooth mode ( $P=0.567$ ,  $P>0.05$ ). For those who use maps navigation while driving tend to entertain their smartphone when it rings ( $P=0.386$ ,  $P>0.05$ ). However, hands-free while driving does not eliminate the adverse effect of smartphone usage while driving [12]. With the current advancement in smartphone functions, the behaviour of browsing and viewing is more frequent. The advent of social media, maps navigation has left drivers completely dependent on their phones [31].

**Table 8** Cochran's Q Analysis Between Different Smartphone Usage Behaviours

No	Smartphone Usage Behaviours		P-value	Hypothesis
1	Check notifications after waking up	Ensure have smartphone before leaving home	0.307	Accept $H_0$
2	Ensure have smartphone before leaving home	Feel uncomfortable when not having smartphone	0.000	Reject $H_0$
3	Receive/ make call while driving	Use hands-free while driving	0.567	Accept $H_0$
4	Using maps navigation while driving	Use smartphone when it rings	0.386	Accept $H_0$

Null hypothesis ( $H_0$ ): Pairing affects each other.  
 $P<0.05$  is statistically significantly different.

Objective two is achieved with results analysis from Section B and Section C. This research identified university students highly depend on their smartphone with the frequent smartphone usage on daily basis for alarm and updates with some willing to skip class for their smartphones. They agreed that smartphone usage can be addictive with common sight of smartphone usage while driving in campus area, even though knowing that this act is dangerous and will result to RTAs. While, university students aged between 21 to 25 years old always had their smartphone with them and will attend their smartphone when it rings.

Findings from Section C analysis also achieved objective three whereby female respondents tend to check on their smartphone frequently compared to male with the overall higher chances of smartphone usage while driving, at traffic light and during congestion, using smartphones for alarm and social connection and they are more likely to feel uncomfortable without their smartphone. While, for male, they tend to use smartphone for maps navigations and calling while driving. Besides, those who had more driving experience tend to use hands-free mode while driving.

#### 4.4. SAFETY PERCEPTIONS

Illustrated in Table 9, in terms of human factor, 97.3% of participants agreed that smartphone usage while driving, at traffic light or when in traffic congestion is a dangerous act. 95.2% of them know that accidents can happen regardless of smartphone usage makes them less guilt to use smartphone while driving. 91.6% of them opt to talking to other when feeling sleepy while driving either via hands-free mode or to their passengers. 80.9% of participants agreed that disturbed emotion is not safe while driving as it will lead to RTAs. Whereas, for environment factor, they do not feel safe when there are surrounding occurrences that will affect their driving (72.5%) and driving with high speed while using smartphone is distracting (84.6%).

**Table 9** Respondent's Perception on Safety

No	Section D: Safety Factor	Total	%
1	Smartphone usage while driving or at traffic light or during traffic congestion is dangerous	361	97.3
2	Accidents can happen even if not smartphone usage	353	95.2
3	I will talk to others if feeling sleepy when driving	340	91.6
4	Accidents can happen when my emotion is disturbed	300	80.9
5	Environment such as raining does not affect my driving	102	27.5
6	Smartphone usage while driving with high speed does not affect me	57	15.4

Due to uneven ratio of female to male, analysis by gender on safety perception is tabulated with percentage of agreed answer per total answer by gender. Based on relative differences between female to male from Table 10, female more prone to RTAs when they are emotional (7.9%). Study found that emotional conversation of phone call while driving can influence drivers' performance irrespective of hands-free or hand-held mode, putting them into significantly more risky situations [12]. Whereas, male could drive and high speed even using smartphone while for female using smartphone is distracting (8.0%). Young males are dominant to be reckless in driving styles with high level of extroversion and thrill seeking. They with little driving experience tend to overestimate their skills [12], [14].

However, there is no significant difference between gender on their perception in safe driving behaviour. This is similar to [9], younger driver were more likely to engage in reading and sending text messages but gender was not significant contributor of this behaviour. Both female and male respondents' perception of smartphone usage while driving, at traffic light and during congestion is dangerous. Yet, many would still use their smartphone in the given situation because RTAs can happen even if not using smartphone. Study found youths find it hard to overcome the temptation and will take their eye and hand off the road to touch their smartphones [19]. Another perception is the safe feeling when talking to others to prevent sleepiness when driving. However, talking on hand-held was rated the second riskiest distraction and talking to passenger is one of the most frequent reported distraction [9].

**Table 10** Safety Perception by Gender

No	Statement from Section D	%	
		Female	Male
1	Smartphone usage while driving or at traffic light or during traffic congestion is dangerous	96.6	98.5
2	Accidents can happen even if not smartphone usage	96.2	93.4
3	I will talk to others if feeling sleepy when driving	91.5	92.0
4	Accidents can happen when my emotion is disturbed	83.8	75.9
5	Environment such as raining does not affect my driving	71.4	70.1
6	Smartphone usage while driving with high speed does not affect me	87.6	79.6

## 5.0 CONCLUSION

Smartphone usage while driving has become a common sight in the campus. University students in this study are very much dependent of their smartphone in their daily life for alarm and checking updates. They make sure to carry their smartphone and would feel uncomfortable without it. While driving, they tend to use smartphone for hands-free call and maps navigation even at traffic light and traffic congestion. Gender, age and driving experience might have some relationship with the smartphone usage behaviours but not significant, further study in required to be conclusive with this regard. While, they have good perception of safe smartphone usage but shown contradicting behaviours on the safe use of smartphone while driving. Hence, education and enforcement are important and relevant among university students to break these risky behaviours of smartphone usage while driving when they are young drivers so that they do not develop such habits as future adult drivers.

### Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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