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ATRANS

ASIAN TRANSPORTATION RESEARCH SOCIETY

# INTEGRATION OF ROAD SAFETY EDUCATION WITH ENGINEERING DESIGN FOR SAFER ROUTES TO SCHOOL

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# CHAPTER 1 Introduction

## 1.1 Background

Road accidents represent a significant contributor to premature death among young individuals on a global scale. Within OECD countries, this cause accounts for 35-40% of injury-related fatalities among teenagers and young adults (OECD-ECMT, 2008). In Thailand, individuals between the ages of 15 and 24 constitute approximately 10-15% of all road traffic fatalities (Road Traffic Death Data Integration (RTDDI), Bureau of Non-Communicable Disease, Thailand).

In the past, the norm for the majority of students in Thailand was to travel to school independently, either by foot or by bicycle. However, in recent times, there has been a noticeable shift in transportation habits, with parents increasingly opting to accompany their children to school by motorcycle or private car. Furthermore, many high school students now choose to ride their own motorcycles to school, even if they live within walking or cycling distance. The reason behind this trend can be attributed to concerns surrounding traffic safety and security, particularly for primary school students. The preference for motorcycles is based on their perceived convenience, while walking and cycling are deemed less safe in terms of both traffic safety and personal security.

The present study reports on the incidence of accidents involving school students during their commute in Thailand, as well as the corresponding modes of travel to school as outlined in Table 1.1, 1.2, and 1.3, respectively. Results indicate that the predominant mode of transportation is motorcycles, either driven independently by students or accompanied by their parents. Although the data suggests a decrease in the incidence of fatalities since 2016, the rate remains substantially high. This is the need for further examination and proactive measures to ensure students safety during travel to school.

**Table 1.1** Statistics on accidents involving students on their way to school in Thailand

| Year | No. of sample | No. of accidents | No. of injury | No. of disability | No. of fatality | Rate of fatality (per 100,000) |
|---|---|---|---|---|---|---|
| 2020 | 261,673 | 52 | 51 | 1 | 1 | 0.38 |
| 2019 | 270,752 | 245 | 259 | - | 5 | 1.85 |
| 2018 | 310,144 | 185 | 267 | 1 | 5 | 1.61 |
| 2017 | 307,604 | 155 | 248 | - | 8 | 2.6 |
| 2016 | 501,287 | 517 | 877 | 1 | 15 | 2.99 |
| 2015 | 451,659 | 234 | 407 | 2 | 11 | 2.44 |
| 2014 | 419,336 | 39 | 194 | - | 8 | 1.91 |
| 2013 | 315,395 | 27 | 75 | 1 | 2 | 0.63 |

Source: Road Accident Victims Protection Company Limited - Road Safety Campus www.rvprsc.com/trafficRSC.php

**Table 1.2** Travel Modes to school

| Travel Modes | No. of sample | Percent (%) |
|---|---|---|
| Riding/Driving | 22,849 | 25 |
| With parents | 25,867 | 29 |
| School bus | 25,436 | 28 |
| Public transport | 9,580 | 11 |
| Walking | 3,625 | 4 |
| **Total** | 89,793 | 100 |

Source: Road Accident Victims Protection Company Limited - Road Safety Campus www.rvprsc.com/trafficRSC.php

**Table 1.3** Riding/Driving modes to school

| Riding/Driving modes | No. of sample | Percent (%) |
|---|---|---|
| Bike | 2,552 | 12 |
| Motorcycle | 18,134 | 85 |
| Car | 255 | 1 |
| Pickup | 285 | 1 |
| Others | 37 | 0 |
| **Total** | 21,263 | 100 |

Source: Road Accident Victims Protection Company Limited - Road Safety Campus www.rvprsc.com/trafficRSC.php

It is very likely that improving driving behaviour can decrease the accident rate significantly. In Thailand, many activities, such as raising public awareness of safe driving through public events and media, improving road geometries, and law enforcement, have been deployed to manage changes in driving behaviour in order to reduce the number of accidents. However, the number of road fatalities in Thailand has still not shown any sign of reduction.

During the last few years, ATRANS Common Research Projects have been attempting to understand traffic safety culture of Thai youngsters. The studies related to youngsters' driving behaviour (2017-2018), road safety education for youngsters (2018-2020), and safe routes to school program (2021-2022).

It has been found that students, mainly motorcyclists, are less likely to perceive road accidents as a serious problem. As a result, they value the convenience of unsafe driving behaviours, such as not wearing a helmet, speeding, and drunk driving, more than the cost of accidents. Road safety education can change road user and driver behaviour, but it must be a structured process. Road safety education should not only provide knowledge of traffic rules and driving skills but also influence attitudes and perceptions toward risk awareness. Instructional and supportive interventions can encourage knowingly risky behaviour and knowingly safe behaviour, while motivational interventions can influence fluently safe behaviour. However, in the previous ATRANS project, the designed motivational intervention to encourage habitual behaviour did not seem to be successful because the designed activity was not attractive. Thus, a new design of motivational interventions is needed.

Developing a Safe Routes to School (SRTS) program involves examining the journeys that students make to and from school and identifying ways to improve safety on these routes. The ATRANS SRTS project found that the majority of students use motorcycles to get to school, even if they live very close, but some are interested in walking, cycling, or using public transport. However, certain needs must be addressed to improve the routes to schools, particularly ensuring that physical infrastructure is safe, comfortable, and attractive. The project also found that young people are less likely to evaluate where and how the current infrastructure is unsafe because they use their routes to school every day and are familiar with the traffic situation and infrastructure. They may not be clear about what constitutes safe and unsafe infrastructure and speed, which may contribute to risky driving behaviours. Additionally, those who have basic knowledge of highway engineering are more aware of safe systems and speeds than those who do not have this knowledge (some students cannot identify safe and unsafe road infrastructure and speeds).

These findings lead to an assumption that:

- students will behave safely on provided road infrastructure if they have knowledge on road safety assessment and basic engineering design, and
- involving road users in auditing road safety and redesigning road infrastructure may be an effective motivational intervention for road safety education.

Road safety education is a critical tool for promoting safe behaviour and reducing road crashes. The goal of road safety education is to provide road users with the knowledge, skills, and attitudes necessary to identify and avoid potential road safety hazards. Road safety education covers all measures that aim at positively influencing traffic behaviour patterns, with three main targets (ROSE 25 project, 2005): (1) promotion of knowledge and understanding of traffic rules and situations, (2) improvement of skills through training and experience, and (3) strengthening and/or changing attitudes toward risk awareness, personal safety and the safety of other road users. Moreover, in broad terms, road safety education (RSE) is teaching children to be safer road users, and providing a foundation and a guide on which the child can develop its own strategy for coping with the dangers and hazards of the road environment (TRL, 1997). Assailly (2017) reviews many road safety education programs and identify characteristics of good practices and found that the most effective teaching methods are those that encourage active student participation (role playing, simulations, etc.) and interaction with adults (discussion). In Thailand Ratanavaraha and Jomnonkwao (2013) highlights the effective of applying the community participation approach to promote and increase the rate of helmet-wearing of people.

Road safety audit (RSA) is a systematic process of evaluating road infrastructure design and operation to identify potential safety hazards and recommend measures to improve safety. During a road safety audit, auditors usually use checklists as a practical tool to guide their work.

Therefore, this research aims to include RSA as a participation activity (role playing as an auditor) of road safety education, in order to provide road users with a better understanding of how road infrastructure can impact their safety and how they can play a role in promoting safer road design and operation.

## 1.2 Objectives

The objectives of this research are: (1) to educate students on road safety assessment and basic engineering design, and (2) to allow students having experiences in auditing road safety and redesigning safer routes to school. This process is to stimulate critical thinking on road safety, leading to increased risk perception, and safe driving behaviour.

## 1.3 Hypothesis

This research attempted to evaluate the effect of integrated programmes for road safety participation on motorcyclist's attitudes toward risk awareness and safe riding behaviour among

the youths. The hypothesis is that knowledge provisions involving road safety, safe systems and basic engineering design, along with motivational intervention and practical training, may build attitudes toward risk awareness and riding behaviour to be safer on the provided road infrastructure. This integrated programme, which allows the youths assess their familiar roads based on the RSA principle, would be an effective motivational intervention for road safety education.

To prove this hypothesis the percentage of change in attitude toward risk awareness and safe riding behaviour should be significantly more positive. In short term, this integration of road safety education with engineering design, may motivate students to comply with traffic rules, avoid risks, act safely, and then survive on the unsafe infrastructure. In long term, it may influence students' attitudes towards risk awareness and habitual safe behaviour.

# CHAPTER 2 Methodology and Case Study

## 2.1 Research procedure

The participation activity to educate road safety education was expected as a key achievement in this research. Therefore, road safety participation programme was divided three main tasks, including:

(1) organising learning sessions for road safety participation programmes,
(2) practical training, and
(3) monitoring and assessment.

Details of three main tasks can be elaborated as shown in Fig. 2.1. After reviewing the gaps from previous studies, obtained idea were applied for planning and organising programme on the target groups. The programmes integrated various learning sessions including safe system, basic engineering design based on RSA and identifying safety map based on Hiyari Hatto concept, in order to educate participants with motivational interventions. One month after learning process, we encouraged participants to apply knowledge gained to audit road safety at their familiar road infrastructure. This practical training under the guidance of experts helped them to build critical thinking in which locations were safe or unsafe for road users. To monitor change in attitudes toward risk awareness and riding behaviour, evaluation was conducted by using pre- and post-activity questionnaire on the same person. Finally, overall performance was concluded and suggested for policy implementation.

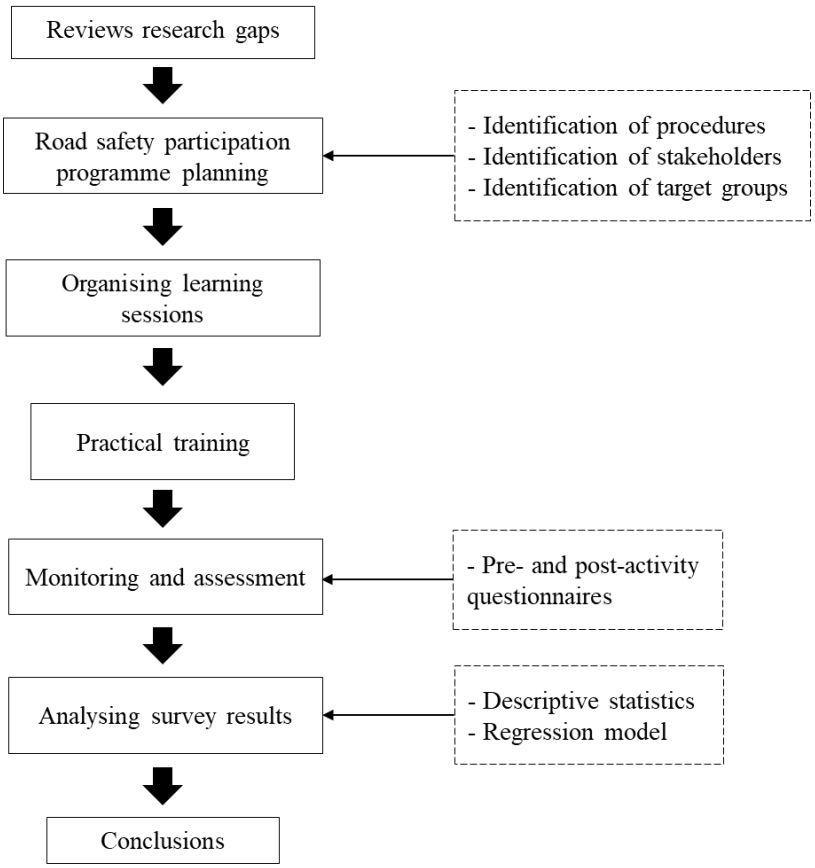


**Figure 2.1** Methodological framework

## 2.2 Case study

To evaluate the effect of road safety participation programme, this research focused on two case studies in different provinces in Thailand as shown in Fig. 2.2, including:

- Suphan Buri province: Suphan Buri Technical College was targeted to organise full course of this programme.
- Songkla province: Prince of Songkla University (PSU) was targeted to lecture on road safety in class.

Two case studies were independent. The full course of road safety participation programme was held at Suphan Buri Technical College, in which students can gain knowledge and experience based on training. While PSU students were provided with knowledge of safe system only, not included practical training.

The research teams included researchers and operation teams such as staffs, schoolteachers, and local government officers as key parties to drive and encourage participation in collaborative workshop, training and collecting data.

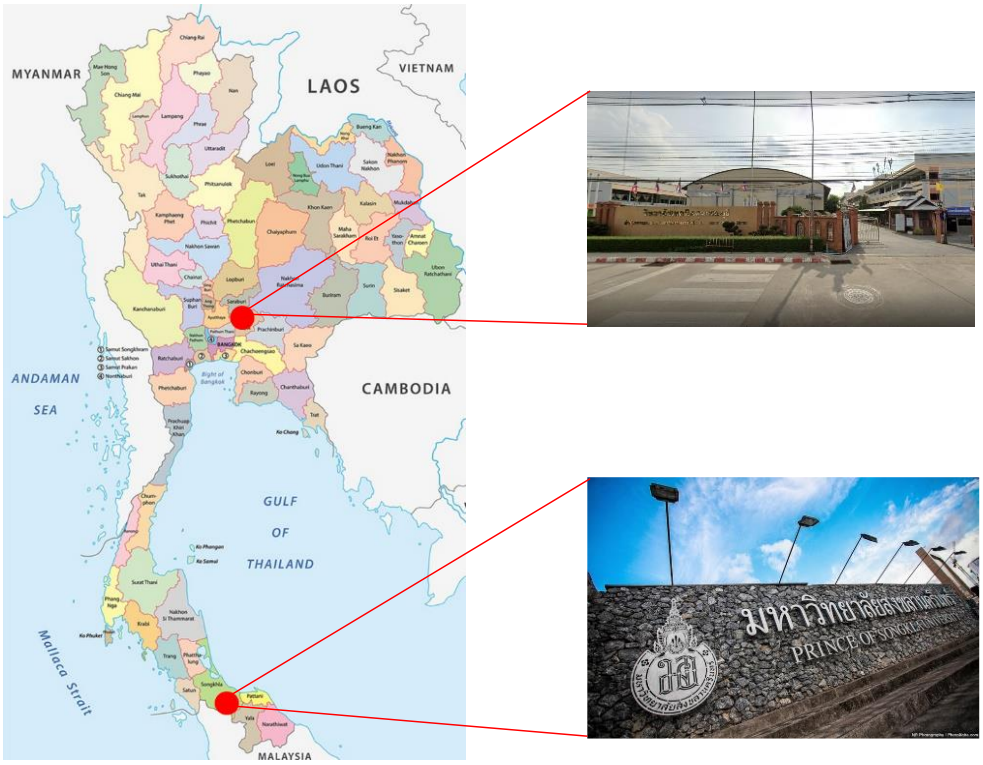


**Figure 2.2** Locations of the two case studies

The case study of Suphan Buri Technical College involved two consecutive workshops held on 11th June and 5th August 2022, with a one-month interval between them. The recruitment of participating students who could attend both days was done by schoolteachers. A self-administered questionnaire survey was used to collect pre- and post-activity data to monitor changes in attitudes toward risk awareness. A sample size of 42 students attended the workshops and completed the questionnaires.

In the case of PSU, as this group was not the main target of the full-course intervention, two student groups were provided with the same contents of safe system knowledge in two separate classes in September and November. A self-administered questionnaire survey was also conducted for pre- and post-activity assessment. There were 449 students in the first class and 66 students in the second class.

## 2.3 Road safety participation programme

### 2.3.1 Organisation of learning sessions

As abovementioned, students in Suphan Buri Technical College were the target group of full-course programme. Thus, the activities to be explained in this section are referred to the case of Suphan Buri Technical College.

The first section of the programme aimed to provide knowledge and was conducted on 11 June and 5 August 2022. To achieve this goal, various programmes were integrated, including a basic background on road safety, safe system, Hiyari Hatto, Atrans Safety Map, and RSA, which were taught by experts. Figures 2.3 and 2.4 present some pictures of the learning sessions. The aim of this section was to help youths understand the context of road safety and become aware of unsafe infrastructure that can cause road accidents. The outcomes of this session could contribute to increasing the awareness of road safety among students.

**Figure 2.3** Organisation of learning sessions 1

**Figure 2.4** Organisation of learning sessions 2

### 2.3.2 Practical training

The practical training section involved the application of knowledge gained through the learning sessions, particularly in the context of the RSA principle, to audit existing road infrastructure. This activity was conducted on 5 August 2022. The 42 participants were initially divided into four groups to evaluate road safety at two sites, the T-junction and sidewalks and road crossing facilities, as shown in Figure 2.5. Two groups were assigned the same situation. Figure 2.6 shows the two groups responsible for different sites. During the assessment, RSA checklists were used along with explanations and guidance by engineering experts. Moreover, students were allowed to ask questions and discuss related problems.

After site visiting, group discussion, and presentation for reflecting on road safety problems and solutions were conducted. Finally, engineering experts helped to summarize the critical problems with initial solutions for both sites, as shown in Figs. 2.7 and 2.8. The outcomes of this section allowed students to gain experience in auditing road safety and redesigning safer routes to school, as well as encouraging critical thinking on road safety, which leads to increased risk perception and safe driving behaviour.


**Figure 2.5** Two sites of road infrastructure as case studies

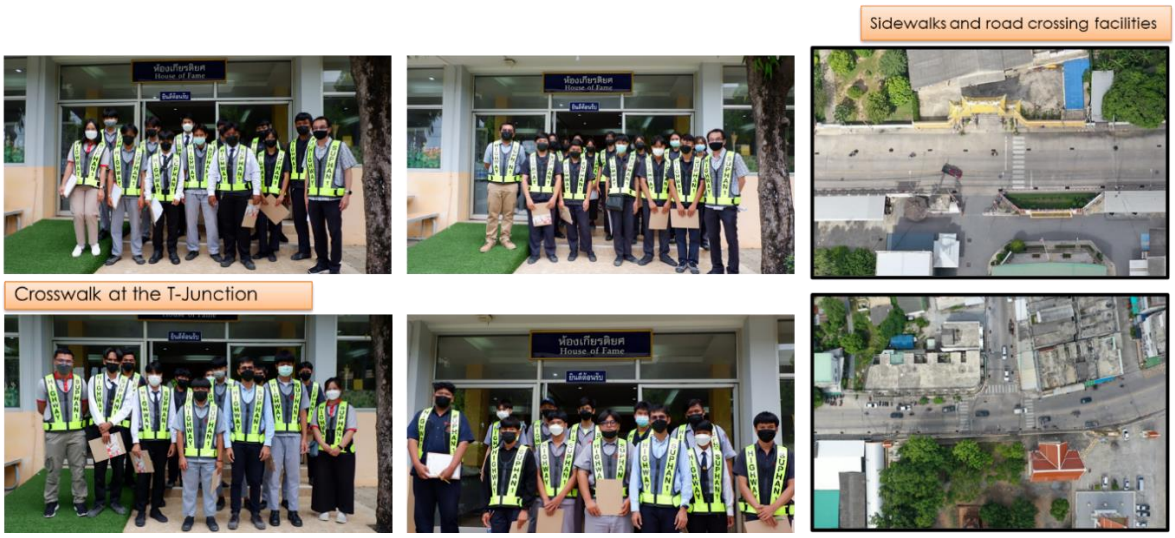


**Figure 2.6** Two groups of participants in this activity


**Figure 2.7** Initial solutions for safer road on T-Junction


**Figure 2.8** Initial solutions for safer road on sidewalks and road crossing facilities

### 2.3.3 Monitoring and assessment

The road safety participation program was assessed through a self-administered questionnaire survey using Google Forms. The survey consisted of pre- and post-activity questionnaires to monitor changes in attitudes towards risk awareness and riding behaviour of the same individuals. The evaluation process concluded with recommendations for improving the road safety education process for young people in Thailand.

## 2.4 Survey design and measures

The survey aimed to gain a comprehensive understanding of the participants' travel behaviour, road accident experience, attitudes towards motorcycle usage, and knowledge of road safety. The questionnaire consisted of three sections.

The first section collected personal characteristics (e.g., student’s id, gender, age, household income, driving license, and accident experience).

The second section comprised three sets of items aimed at assessing the following aspects: (1) the rider's attitudes towards motorcycle usage, (2) their risk awareness regarding motorcycle usage, and (3) their motorcycle usage behaviours.

1. The attitudes towards motorcycle usage were assessed through two aspects, focusing on safe behaviour (5 items) and risk behaviour (7 items). The questionnaire aimed to capture general attitudes towards safe and risky driving behaviours in specific situations. Participants were asked to rate their level of agreement on a five-point Likert scale, with 5 indicating strong agreement and 1 indicating strong disagreement.

    Safe behaviour aspect (5 items)
    - Attending safe driving training every year is essential.
    - Knowledge of safe driving is important.
    - If you feel tired or sleepy while driving, you should stop the car/motorcycle and rest.
    - Violating traffic law is something that should not be done because it can cause life threatening.
    - Check the condition of the vehicle before driving every time to reduce the risk of accidents.

Risk behaviour aspect (7 items)

- Driving with 3-4 people, saving time and money.
- The U-turn point is far away, which wastes time. Thus, it is better to drive against the traffic flow.
- Using a phone while driving is possible if you are careful.
- Use high speed to reach the destination quickly.
- Helmets are uncomfortable for driving.
- Drinking alcohol before driving does not reduce the efficiency of driving.
- Driving with a license is unimportant.

2. Risk awareness of motorcycle usage (5 items) involved perception of risk awareness and risk prediction when driving in different traffic situations. A five-point Likert scale (5=agree, 1=disagree) was used to measure five items.
    - I don't drive motorcycles at high speeds, so I don't need to wear a helmet.
    - I can drive against the traffic flow if I need to and there are no oncoming cars.
    - I have many years of driving experience and I am able to drive at high speed in areas where accidents have occurred.
    - Modifying motorcycle doesn't mean losing control while driving.
    - I can drive through red lights at late night when I can't see the car in the near distance.

3. Driving behaviours was measured using a frequency scale (ranging from 80-100% [5] = always, 0-20% [1] = never). This part presented some potential risky behaviour when using motorcycle, whereby the students were asked how often they performed these behaviours.
    - Driving with overloaded people.
    - Driving against the traffic flow.
    - Driving when you feel tired or sleepy.
    - Violating of traffic lights when the road is empty.
    - Neglecting to check the condition of vehicle before driving.
    - Using a phone when driving.
    - Driving over speed limit.
    - Not wearing a helmet at close distance.
    - Driving after drinking alcohol.
    - Driving without license.

The third section was used to assess the knowledge gained from learning sessions in accordance with the content of road safety (10 items) and road safety audit (5 items). Students

were asked multiple-choice to choose the correct one. The score of each student can reflect whether the student pay attention while learning.

The pre- and post-activity questionnaires were largely similar, except for the section related to motorcycle usage behaviours. In the pre-activity questionnaire, participants were asked about their driving behaviours over the past month, while in the post-activity questionnaire, they were asked about their intended driving behaviours in the future.

## 2.5 Data analysis

To provide an in-depth understanding of the data, descriptive statistics were conducted to describe the characteristics of the data, such as percentage, mean, and standard deviation (SD). Furthermore, inferential statistics, specifically multiple regression analysis, were employed to investigate the relationship between factors that influence risk behaviour in motorcycle usage. The evaluation of the performance of the participation activity was based on the comparison of the change in the percentage of attitude toward risk awareness and knowledge gained.

# CHAPTER 3 Results

This chapter presents the results of the integrated programme for road safety education. The first part aimed to understand personal characteristics and driving experiences. The second part aimed to investigate the effect of participation in the activity on students' attitudes towards motorcycle usage. The later parts focused on exploring the impact of motorcycle usage on risk awareness and risk behaviour. Finally, the levels of knowledge gained from this activity were examined.

## 3.1 Descriptive of personal characteristics and experience of road accidents

The personal characteristics of students from Suphan Buri Technical College for the first and second workshops are illustrated in Table 3.1.

**Table 3.1** Sample profiles for Suphan Buri Technical College

| **Characteristics** | | **Percentage (%)** | |
|---|---|---|---|
| | | **1st workshop** | **2nd workshop** |
| Gender | Male | 70 | 80 |
| | Female | 30 | 20 |
| Age (year) | 15 | 10 | 17 |
| | 16 | 7 | 17 |
| | 17 | 19 | 28 |
| | 18 | 45 | 28 |
| | 19 | 17 | 11 |
| | 21 | 2 | 0 |
| Driving experience in year | Less than a year | 7 | 0 |
| | Less than 3 years | 14 | 17 |
| | 3 years or more | 79 | 83 |
| Experience of traffic accidents | Severe injury | 7 | 6 |
| | Moderate injury | 29 | 28 |
| | Minor injury | 24 | 17 |
| | Never | 40 | 50 |
| No motorcycle driving licence | | 45 | 57 |

According to the recruitment announcement, students who were able to attend both workshops were welcome. However, since it was difficult for students to anticipate their future availability, only around 50% of the students who attended the first workshop were able to attend the second workshop. As a result, there were some differences in the characteristics of the samples between the two workshops.

Regarding the first workshop, male respondents accounted for 70% of the sample, while female respondents accounted for 30%. This is consistent with the statistics on the number of students enrolled in suphan buri technical college, which indicate that there are more male students than female students. The majority of the participants were between the ages of 18 and 21 (64%), followed by the age group of 15 to 17 (36%). In terms of driving experience, 79% of the participants had more than 3 years of driving experience, while 21% had less than 3 years of experience. With regards to traffic accidents, 40% of the participants reported that they had never been in an accident, while 60% had been in an accident and 7% had experienced a severe accident in the past. Interestingly, 45% of the sample did not have a motorcycle driving license, which may suggest that these participants have a relatively low level of knowledge of safe driving practices.

The second workshop had a different set of students, with half of the participants being different from those in the first workshop. Male respondents accounted for 80% of the sample, while female respondents accounted for 20%. The majority of the participants in this group were between the ages of 15 to 18, and 57% of the sample did not have a motorcycle driving license.

Table 3.2 presents the personal characteristics of the students from PSU for the first and second classes. Since this group consisted of university students, they were between 18 to 22 years old. The percentage of female students was higher than male students, accounting for about 80% and 20%, respectively. The majority of students with riding experience over 3 years accounted for 59% and 92% of the first and second classes, respectively. Students who did not have a motorcycle driving license accounted for 64% of the first class and 30% of the second class; this may be because the students in the second class were senior-level (over 3rd-year) students. The highest percentage of students in the first class who had never been in road accidents was 48%, while 51% of the second class reported experiencing minor injuries.

**Table 3.2** Sample profiles for PSU

| Characteristics | | Percentage (%) | |
|---|---|---|---|
| | | 1st class | 2nd class |
| Gender | Male | 20 | 17 |
| | Female | 80 | 83 |
| Age (year) | 18 | 17 | 0 |
| | 19 | 37 | 0 |
| | 20 | 29 | 32 |
| | 21 | 10 | 57 |
| | 22 | 7 | 11 |
| Driving experience in year | No experience | 25 | 2 |
| | Less than a year | 7 | 2 |
| | 2 years | 4 | 2 |
| | 3 years or more | 64 | 94 |
| Experience of traffic accidents | Severe injury | 2 | 3 |
| | Moderate injury | 13 | 20 |
| | Minor injury | 36 | 51 |
| | Never | 48 | 26 |
| No driving licence | | 64 | 30 |

Table 3.3 presents the relationship between age and experience of motorcycle usage for the two case studies, where the sum of the age column in each case is 100%. In Thailand, by law, the minimum driving age for a motorcycle (MC) is 15 years old. However, it was found that many motorcyclists were younger than 15 years old. The survey found that a high percentage of students had experience using MCs for more than 3 years, even at the ages of 15-16, especially in the case of Suphan Buri Technical College. This may be due to the available travel mode choices from home to school in the local area.

**Table 3.3** Relationship between age and experience of motorcycle usages

| Group | Experience of MC usage | Age (year) | | | | | |
|---|---|---|---|---|---|---|---|
| | | **15** | **16** | **17** | **18** | **19** | **20+** |
| Suphan Buri Technical College | Less than a year | 0% | 17% | 8% | 4% | 0% | 0% |
| | 2 years | 14% | 0% | 8% | 0% | 11% | 0% |
| | 3 years or more | **86%** | 83% | 85% | 96% | 89% | 100% |
| PSU students | No experience | 0% | 0% | 0% | 30% | 34% | 13% |
| | Less than a year | 0% | 0% | 0% | 18% | 5% | 4% |
| | 2 years | 0% | 0% | 0% | 17% | 4% | 5% |
| | 3 years or more | 0% | 0% | 0% | **35%** | 57% | 78% |

In addition, Table 3.4 presents the relationship between experience of motorcycle usage and the lack of motorcycle driving license. Surprisingly, students who did not have a driving license still used motorcycles regularly. In fact, 89% of students in Suphan Buri Technical College had experience using motorcycles for 3 years or more but lacked a license, which was associated with a high percentage of traffic accidents.

**Table 3.4** Relationship between experience of motorcycle usages and the lack of motorcycle driving licence

| Group / No motorcycle driving licence | No experience (%) | Less than a year (%) | Less than 3 years (%) | 3 years or more (%) |
|---|---|---|---|---|
| Suphan Buri Technical College | 0 | 7 | 4 | **89** |
| PSU students | 7 | 3 | **53** | 37 |

Table 3.5 summarises the survey results, which provide insights into the risk factors of road accidents and emphasise the need for appropriate preventive measures. The two case studies reported similar findings, with bad road conditions (such as slippery roads, rough roads, and poor visibility) being the most common risk factor contributing to road accidents, followed by carelessness from other road users and driving at high speeds. These findings reflect the unsafe road infrastructure that students often encounter, leading to injuries and deaths. This is in line with the findings of Lankarani et al., 2014. Thus, it is believed that the integrated programme, which educates students about where and how road infrastructure is unsafe for driving, could be an effective way to prevent road injuries.

**Table 3.5** Causes of accidents

| Causes of accident | Percent (%) | |
|---|---|---|
| | Suphan Buri Technical College | PSU |
| Carelessness from others | 22 | 35 |
| Bad environment / road (e.g., slippery road, rough road, poor visibility) | **56** | **42** |
| Driving with high speed | 9 | 8 |
| Unfamiliar with the route | 0 | 8 |
| Disobeying traffic lights | 0 | 1 |
| Others | 13 | 6 |

## 3.2 Effect of road safety participation programme on attitude of motorcycle usage

This section presents items relevant to the attitude towards motorcycle usage, which have been divided into two aspects: safety behavior and risky behavior. To evaluate the effect of participation in the activity, the responses from pre- and post-activity questionnaires were

compared using a bar chart to illustrate the descriptive statistics of each item. The mean score and standard deviation (SD) were computed based on Likert guidelines. In this research, the percentages of "strongly agree" and "agree" were combined to provide a clear comparison between before and after the activity. For example, a high score in the safety behavior aspect indicated a strong preference for safe driving attitudes, implying a positive attitude towards safe behavior. In contrast, a higher score in risky behavior indicated a lower recognition of risk awareness, reflecting a negative attitude towards risk awareness.

The results of the first workshop held at Suphan Buri Technical College is shown in Figure 3.1. The students' attitudes towards safety behaviour seemed to have slightly increased compared to before the activity, while their attitudes towards risky behaviour slightly decreased. This suggests that the learning session was effective in reinforcing students' attitudes towards motorcycle driving. Checking the vehicle before driving (mean: +0.24) was found to play an important role in determining these attitudes.

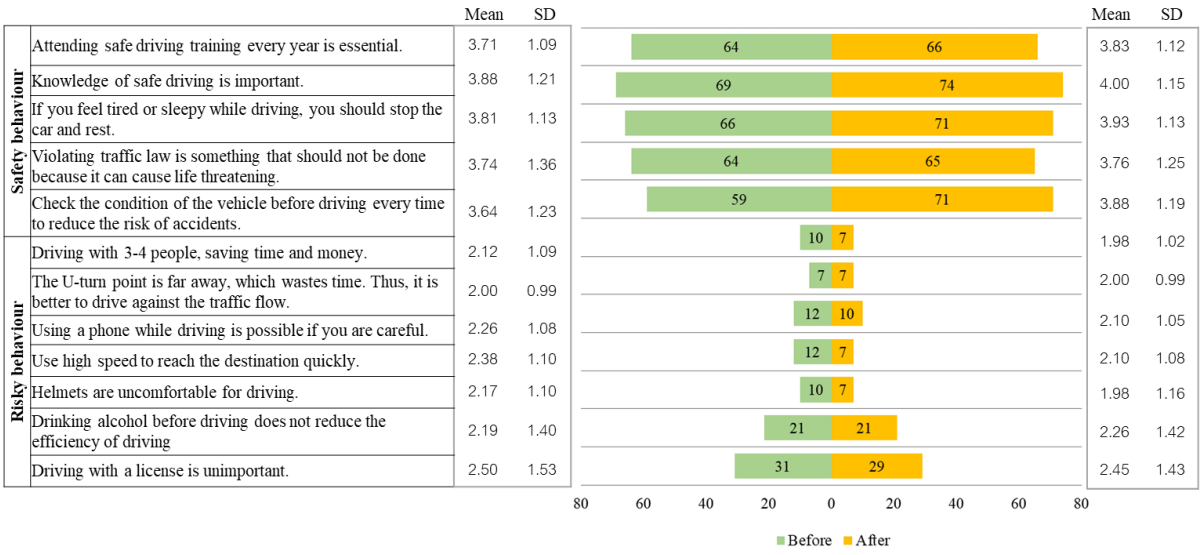


**Figure 3.1** Attitude of motorcycle usage for the 1st workshop in Suphan Buri Technical College

Figure 3.2 illustrates the effect of participation in the second workshop on attitudes towards motorcycle usage. Surprisingly, the results showed that students had lower positive attitudes towards safety behaviour compared to before the activity. It is possible that they misinterpreted some of the questions. However, there was a slight decrease in negative attitudes towards risky behaviour, which was consistent with the purpose of the activity. Interestingly, most students seemed to recognize the risks associated with using high speeds to reach their destination.

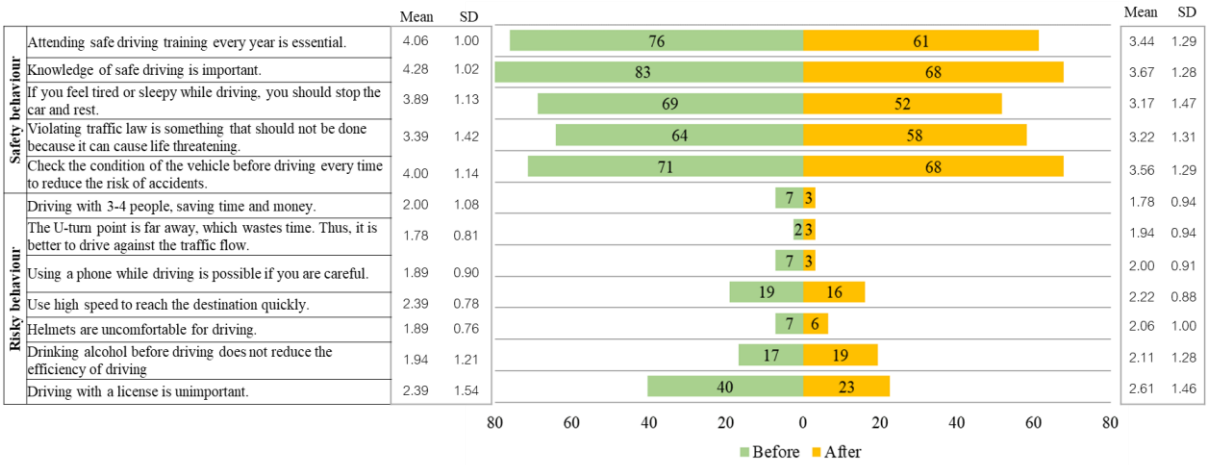


**Figure 3.2** Attitude of motorcycle usage for the 2nd workshop in Suphan Buri Technical College

To compare the results with another case study, Figures 3.3 and 3.4 show the attitudes towards motorcycle usage among PSU students in the first and second class, respectively. In Figure 3.3, the results for safety behaviour indicate that student attitudes significantly increased compared to before the activity. However, the attitude towards attending safe driving training every year showed only a slight increase.

In Figure 3.4, the results for safety behaviour show that student attitudes slightly increased compared to before the activity, while their attitudes towards risky behaviour slightly decreased based on the means/scale. The findings of both case studies support the idea that learning sessions can reinforce students' attitudes towards motorcycle driving.

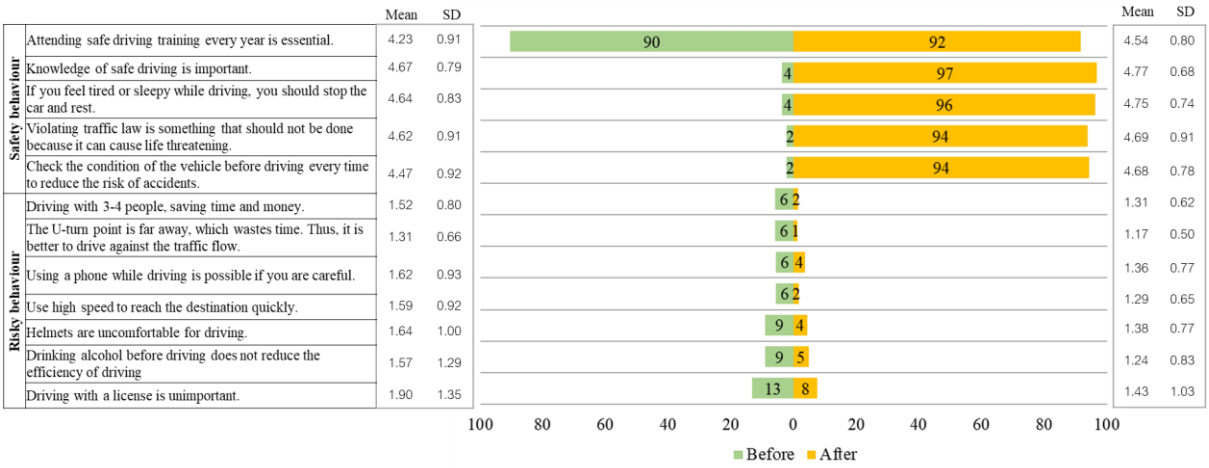


**Figure 3.3** Attitude of motorcycle usage for the 1st class in PSU

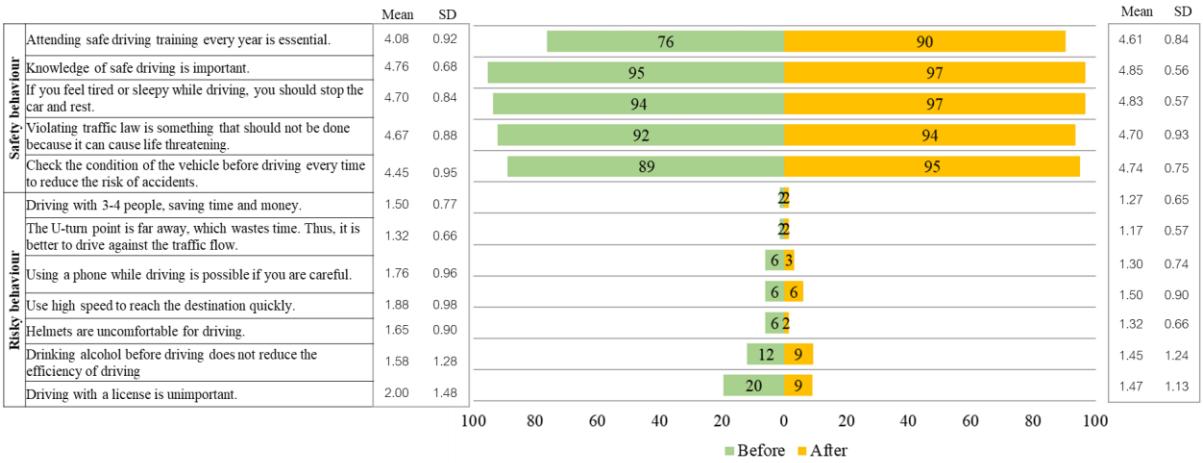


**Figure 3.4** Attitude of motorcycle usage for the 2nd class in PSU

## 3.3 Effect of road safety participation on risk awareness of motorcycle usage

This section presents the items relevant to the risk awareness of motorcycle usage. Figure 3.5 illustrates the risk awareness results for the first workshop held at Suphan Buri Technical College. As the questions were on the negative side of risk awareness, a higher score indicated less awareness of risky behaviour. The results show that the motivational intervention raised awareness of all situations related to risk for greater safety (means decreased). Considering the scale of each issue, the students were most aware of the risks associated with driving against traffic flow if they need to and there were no oncoming cars (scale decreased by 2%), and especially driving through red lights late at night when they cannot see the cars in the near distance (scale significantly decreased by 15%). However, there was no significant effect of the intervention on driving at high-speed, wearing helmets, and modifying the car. Therefore, these three factors should be emphasized more.

Figure 3.6 shows the results for the risk awareness of motorcycle usage for the second workshop held at Suphan Buri Technical College. Some of the risk awareness results were in contrast to the previous workshop. Students were more aware of the importance of wearing helmets (scale decreased by 1%) and driving against the traffic flow if there were no oncoming cars (scale decreased by 7%). However, there was no significant effect of the intervention on driving at high speed, modifying the car, and driving through red lights. The findings suggest that driving at high speed and modifying the car are two factors that require more intervention for this student group.

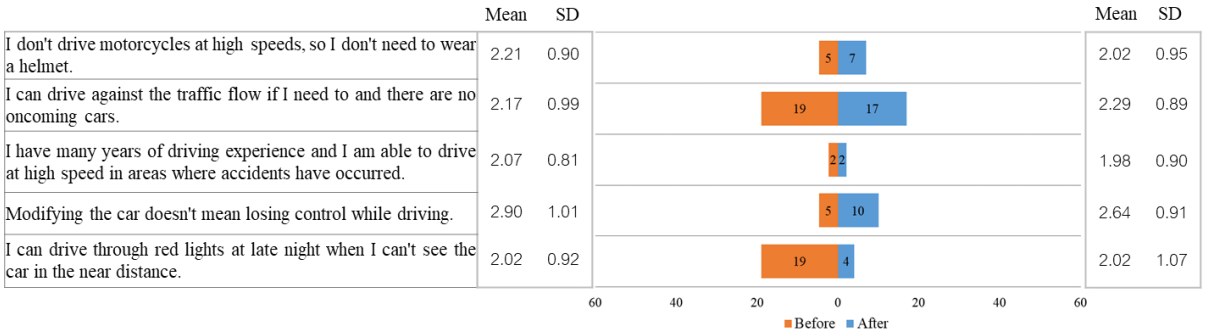


**Figure 3.5** Risk awareness of motorcycle usage for the 1st workshop in Suphan Buri Technical College

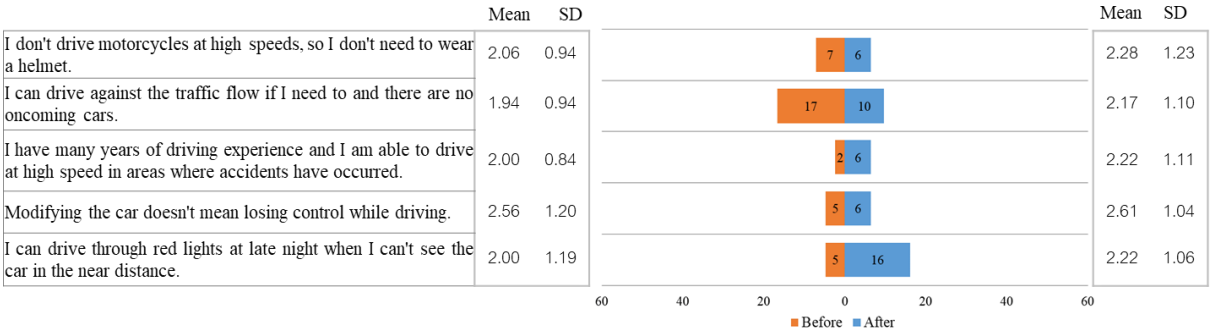


**Figure 3.6** Risk awareness of motorcycle usage for the 2nd workshop in Suphan Buri Technical College

Before learning the road safety lecture in the first class, the PSU students (see Fig. 3.7) had very low risk awareness of safe driving motorcycle as shown in almost 100% of agree side. However, after learning they can totally be aware of the risky behaviour. The motivational intervention is very successful with this group, this might be because the University students have ability to learn, and their attitudes can be interfered compared to technical college students.

Before attending the road safety lecture in the first class, the PSU students had very low risk awareness regarding safe motorcycle driving, as shown by the almost 100% agreement on the agree side in Fig. 3.7. However, after attending the lecture, the students became much more aware of the risks involved in motorcycle driving. The motivational intervention was very successful with this group, possibly due to the students' ability to learn, understand and change attitude, as compared to the technical college students.

Fig. 3.8 shows that the PSU students already had a high level of risk awareness regarding safe motorcycle driving before attending the road safety lecture. However, their concerns about traffic accidents increased slightly after attending the lecture. This indicates that the road safety education was successful in reinforcing risk awareness in this group of university students.

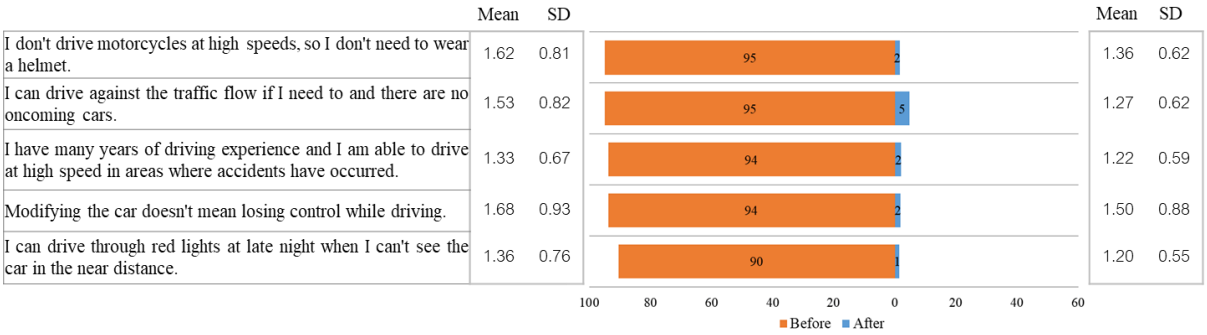


**Figure 3.7** Risk awareness of motorcycle usage for the 1st class in PSU

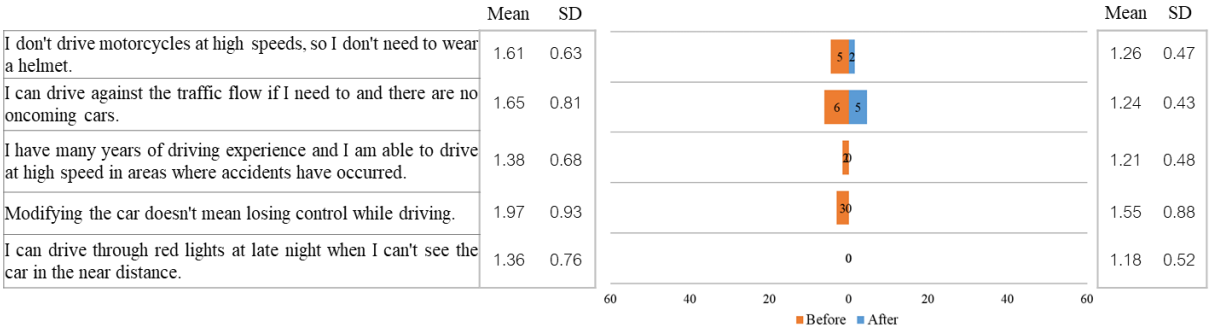


**Figure 3.8** Risk awareness of motorcycle usage for the 2nd class in PSU

## 3.4 Effect of road safety participation on risk behaviour of motorcycle usage

As mentioned in Chapter 2, the risk behaviour of motorcycle usage has two definitions. Risk behaviour in the past-one month was asked in the pre-activity questionnaire, while risk behavioural intention in the future was measured in the post-activity questionnaire.

Figure 3.9 presents a series of questions relevant to the risk behaviour of using motorcycles in the past. These results are from the first workshop at Suphan Buri Technical College. Before the learning session, the risky behaviours concerned included driving over the speed limit, not wearing a helmet for a short distance, neglecting to check the condition of the vehicle before driving, and using a phone while driving, respectively. The most influential factor in preventing risky behaviour was driving without alcohol, with 62% of students reporting never behaving recklessly.

Figure 3.10 illustrates the effect of participation in activities on the intention towards risk behaviour in the same group. The tendency towards intentional behaviour in the future seems to be safer than before the activity, as the proportion of students choosing "never" significantly

increased for most issues. Therefore, this result supports the notion that learning sessions can encourage students to change their driving behaviour and become safer.

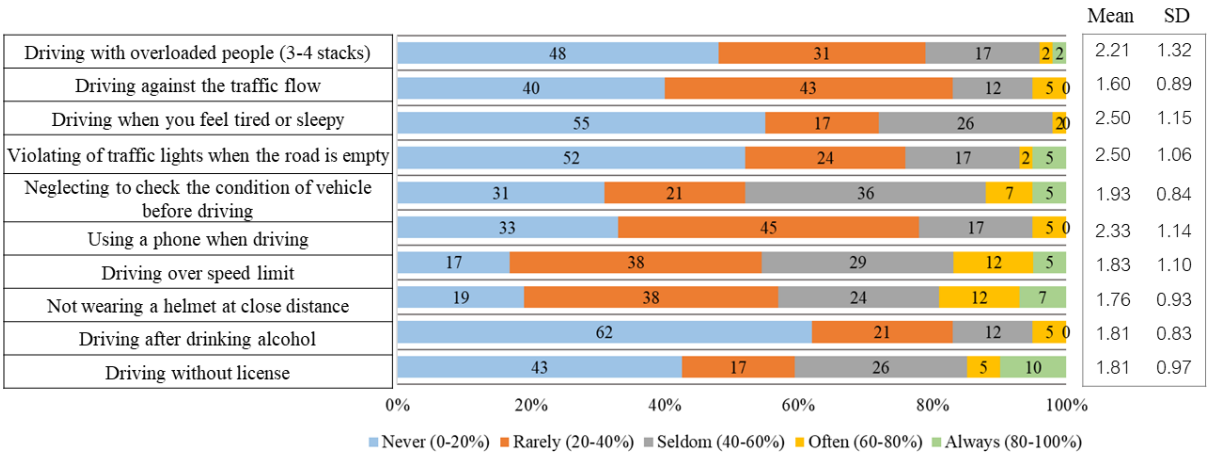


**Figure 3.9** Risk behaviour of motorcycle usage in the past for the 1st workshop in Suphan Buri Technical College

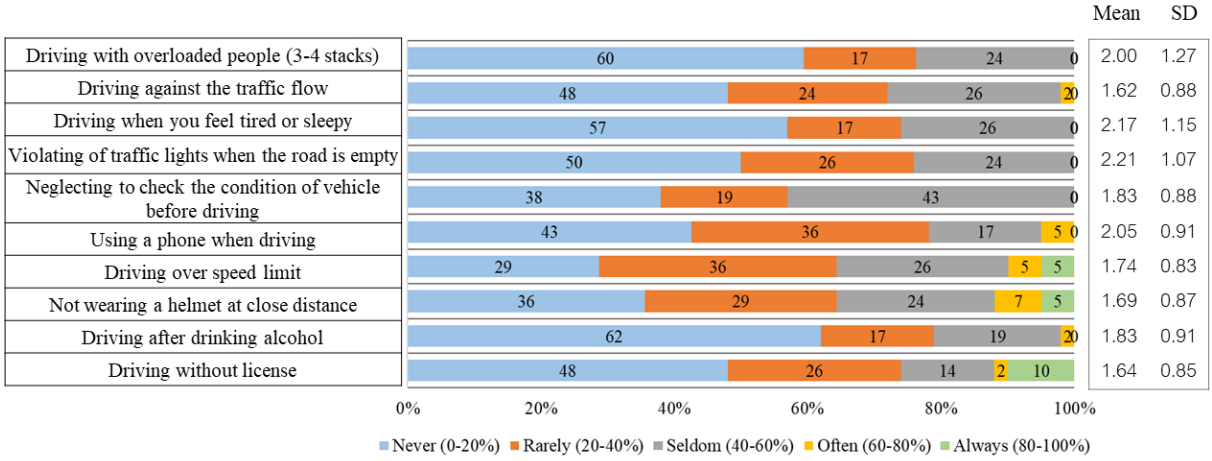


**Figure 3.10** Risk behavioural intention in the future for the 1st workshop in Suphan Buri Technical College

The risky behaviour in the past and intention in the future of Suphan Buri Technical College in the second workshop are presented in Figs. 3.11 and 3.12, respectively. Before the activity, the risky behaviours concerned driving over the speed limit, not wearing a helmet for short distances, driving without a license, and neglecting to check the condition of the vehicle before driving, respectively. Driving with overloaded vehicles (never 74%) was the most influential factor in preventing risky behaviour among students. However, the effect of the activity changed their perception of hazards, with factors such as driving over the speed limit, not wearing a helmet at close distances, and driving without a license showing a significant increase in the proportion of students who chose "never" to perform in the future.

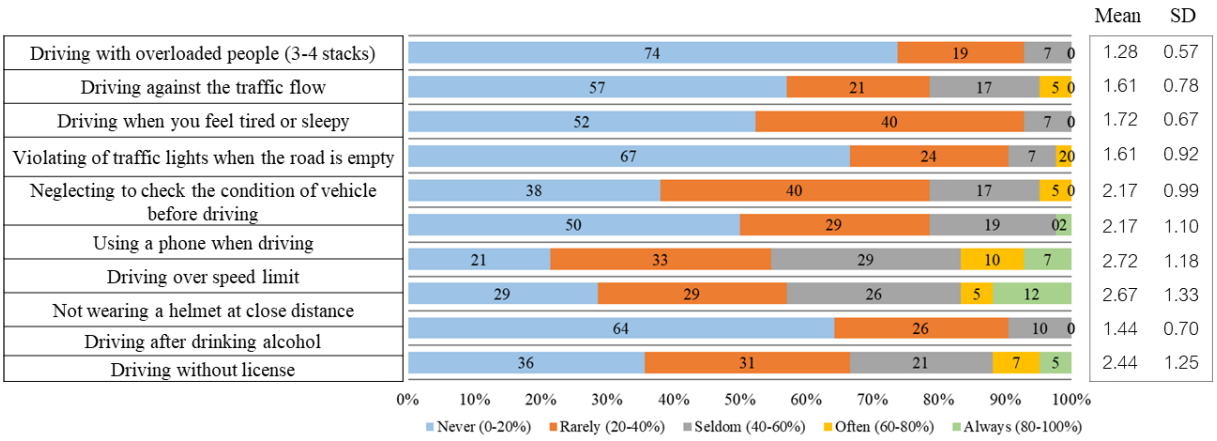


**Figure 3.11** Risk behaviour of motorcycle usage in the past for the 2nd workshop in Suphan Buri Technical College

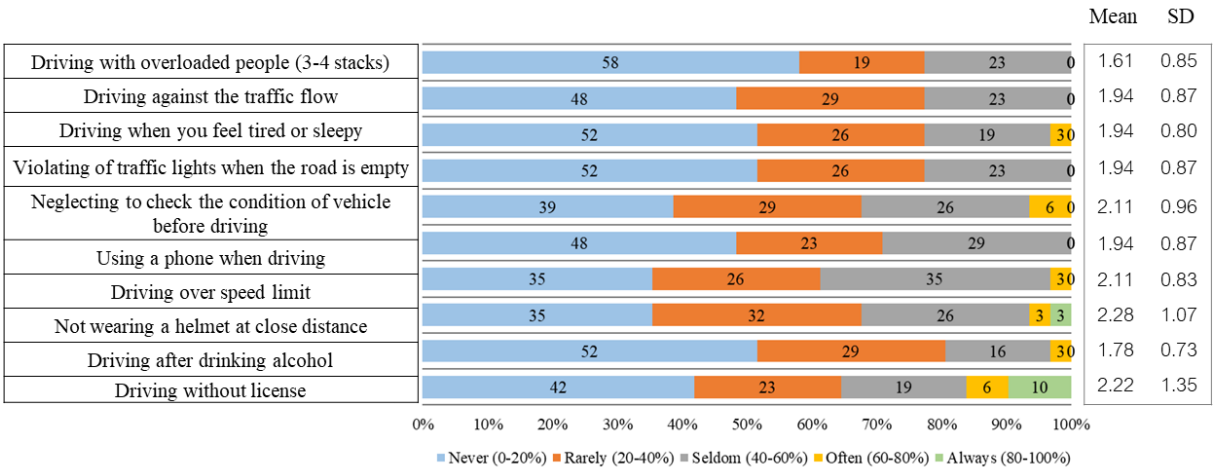


**Figure 3.12** Risk behavioural intention in the future for the 2nd workshop in Suphan Buri Technical College

The results of PSU students in the first and second classes are shown in Figs. 3.13-3.16. In the first class (Fig. 3.13), the risky behaviours in the past included not wearing a helmet for short distances and neglecting to check the condition of the vehicle before driving. Driving without alcohol (never 86%) was the most influential factor in preventing risky behaviour among students. The tendency towards intentional behaviour in the future seemed to be safer than before the activity (Fig. 3.14), as the proportion of students choosing "never" significantly increased for all issues. Not wearing a helmet for short distances was identified as an important risk factor.

The results of the second class (Fig. 3.15) show that the risky behaviours in the past included not wearing a helmet for short distances and neglecting to check the condition of the vehicle before driving. Driving without alcohol (never 86%) was the most influential factor in preventing

risky behaviour among students. As shown in Fig. 3.16, students intended to exhibit safer driving in the future, with the proportion of students choosing "never" significantly increasing for all issues. However, not wearing a helmet for short distances remained an important risk factor, as some students continued to engage in this behaviour. Based on the two case studies, the results support the notion that an integrated program with basic engineering design can encourage students to change their driving behaviour and become safer.

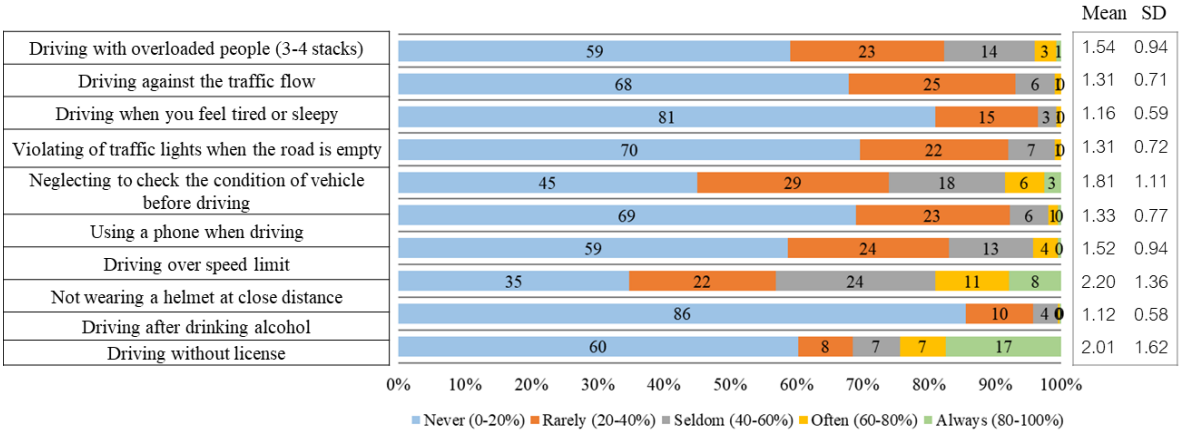


**Figure 3.13** Risk behaviour of motorcycle usage in the past for the 1st class in PSU

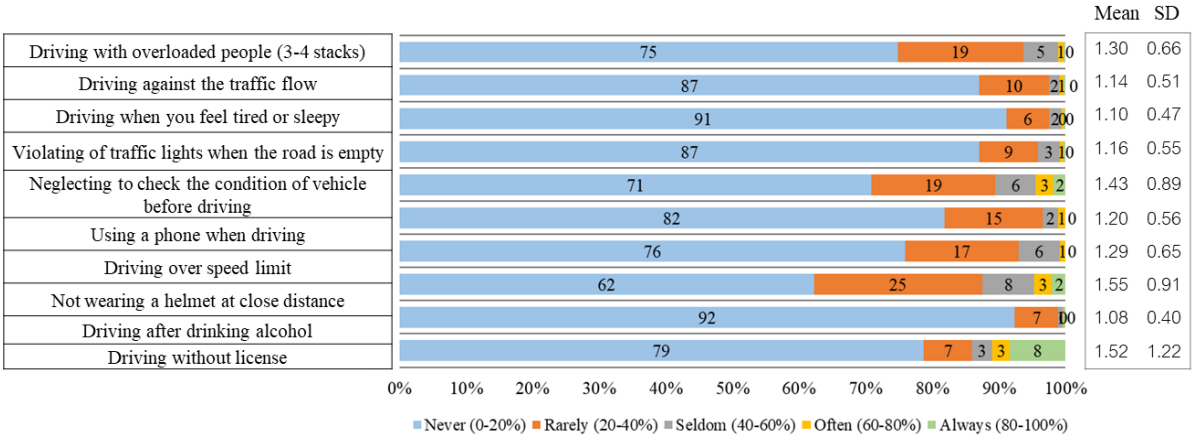


**Figure 3.14** Risk behavioural intention in the future for the 1st class in PSU

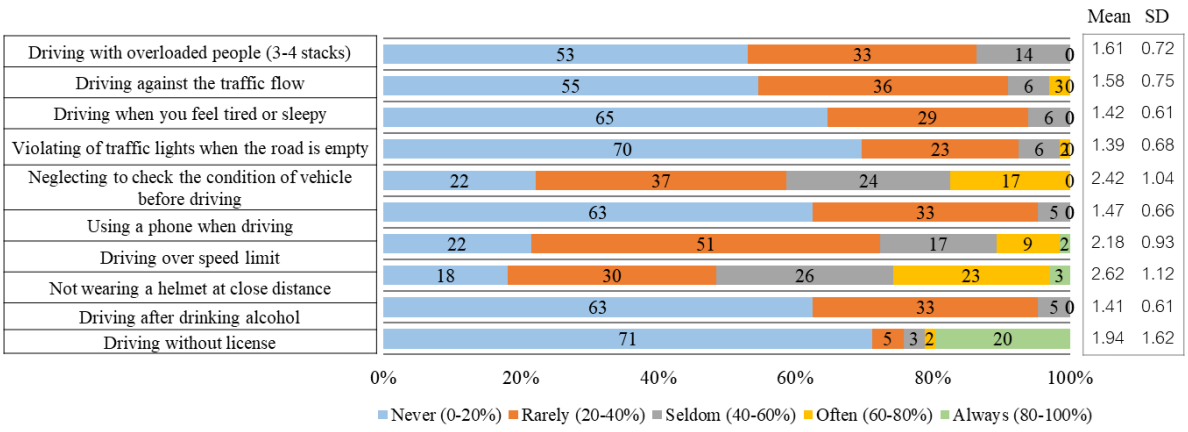


**Figure 3.15** Risk behaviour of motorcycle usage in the past for the 2nd class in PSU

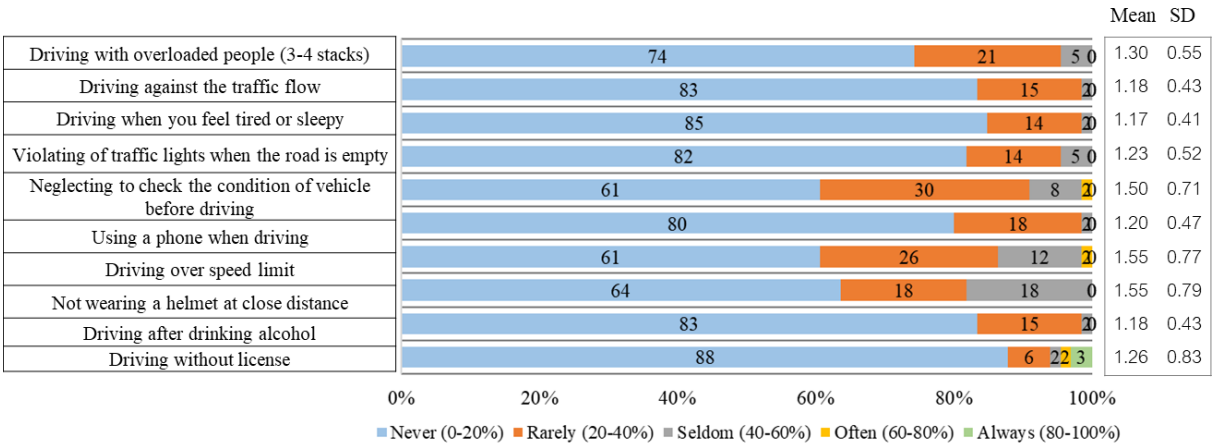


**Figure 3.16** Risk behavioural intention in the future for the 2nd class in PSU

## 3.5 Knowledge of road safety

The pre- and post-activity questionnaire was conducted to measure the knowledge of road safety and the knowledge of RSA. The questionnaire consisted of 10 multiple-choice questions on road safety and 5 multiple-choice questions on RSA. The questionnaire was administered via a Google Form. It is worth noting that PSU students only learn about road safety, so their total score can only reach a maximum of 10 points.

Evaluation of the effectiveness of the activity in attracting students' attention was conducted by comparing the levels of knowledge gained by students before and after the activity, as summarized in Table 3.6. The findings indicate that the activity led to a significant increase in college students' knowledge, although 30% of the students still lagged behind. On the other hand, university students, who already had good background knowledge, responded very positively to the motivational intervention, even when studying in large classrooms.

**Table 3.6** Change in the levels of road safety knowledge

| Score | 1st workshop | | % change | 2nd workshop | | % change | 1st class | | % change | 2nd class | | % change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before | After | | Before | After | | Before | After | | Before | After | |
| 0-5 | 38% | 31% | -7 | 40% | 32% | -8 | 22% | 7% | -15 | 17% | 0% | -17 |
| 6-10 | 60% | 52% | -8 | 57% | 61% | +4 | 78% | 93% | +15 | 83% | 100% | +17 |
| 11-15 | 2% | 17% | +15 | 2% | 6% | +4 | n/a | n/a | n/a | n/a | n/a | n/a |

## 3.6 Effect of influencing factors on motorcycle driving behaviour

The correct grammar for the sentence is: "To examine the factors influencing motorcycle driving behaviour, the regression model was applied. The factors considered include risky attitude,

safety attitude, risk awareness, knowledge score, and past behaviour. The mean score of each factor was used to find the coefficient affecting motorcycle driving behaviour.

The results of the analysis model are presented in Tables 3.7 and 3.8 for Suphan Buri Technical College and PSU students, respectively. Two separate models were considered to examine the influence of attitude, risk awareness, and knowledge on the past one-month behaviour of driving a motorcycle (Model 1) and the influence of these factors on the intention of driving a motorcycle in the future (Model 2).

The results of Table 3.7 show that Model 2, which included 5 variables, had slightly higher predictive power (Adjusted R2 = 39.46%) than Model 1 (39.35%). The trends of influencing factors for both models were similar; risk awareness and knowledge score had a significantly negative effect on the risky behaviour of using a motorcycle. This reflects that students who gain more knowledge of road safety and are aware of the risks of traffic accidents tend to behave in a safer driving manner.

However, safety attitude had a significantly positive influence on the risky behaviour of using a motorcycle, implying that even students in this group who perceive a positive attitude toward safe driving behaviour are likely to use motorcycles unsafely, which may be caused by their past behaviour (positive effect but not significant in Model 2).

**Table 3.7** Regression analysis results of students in Suphan Buri Technical College

| Variables | Past 1-month behaviour model | | Driving behavioural intention model | |
|---|---|---|---|---|
| | **Estimate** | **t-value** | **Estimate** | **t-value** |
| (Intercept) | 3.700 | 5.28*** | 3.171 | 3.655*** |
| Risky attitude | -0.038 | -0.343 | -0.026 | -0.238 |
| Safety attitude | 0.253 | 2.808** | 0.227 | 2.434* |
| Risk awareness | -0.450 | -3.091** | -0.393 | -2.533* |
| Knowledge score | -0.135 | -3.934*** | -0.122 | -3.373** |
| Past behaviour | - | - | 0.145 | 1.032 |
| Adjusted $R^2$ | 0.3935 | | 0.3946 | |

Table 3.8 shows that Model 2, with 5 variables, had slightly higher predictive power (Adjusted R2 =34.77%) than Model 1 (28.25%). There were some significant differences in the influencing factors compared to the other student group. Risk awareness had a significantly positive effect on the risky behaviour of riding motorcycles in Model 1, but not in Model 2. This result is consistent with the previous group, indicating that students who are aware of the risks of traffic accidents are more likely to behave in a safe driving manner. This result supports the findings of Chou et al. (2022), who identified attitude as an important determinant of motorcycle driving

behaviour. Risky attitude had a significantly positive influence on the risky behaviour of using motorcycles, meaning that PSU students who have a negative attitude toward unsafe driving behaviour are more likely to use motorcycles safely. Additionally, the past 1-month behaviour had a significantly positive influence on the risky behaviour of riding motorcycles, suggesting that past riding behaviour can predict future intent to engage in safe or unsafe driving behaviour. For those who exhibit unsafe behaviour, educational interventions alone may not be sufficient to change their behaviour, and other measures should be employed.

**Table 3.8** Regression analysis results of PSU students

| Variables | Past 1-month behaviour model | | Driving behavioural intention model | |
|---|---|---|---|---|
| | **Estimate** | **t-value** | **Estimate** | **t-value** |
| (Intercept) | 1.7107 | 4.57*** | 1.0364 | 2.773 |
| Risky attitude | 0.3127 | 5.482*** | 0.2798 | 5.119 |
| Safety attitude | -0.0055 | -0.178 | -0.0064 | -0.216 |
| Risk awareness | -0.1642 | -2.888** | -0.0928 | -1.674 |
| Knowledge score | -0.0034 | -0.192 | -0.0021 | -0.125 |
| Past behaviour | - | - | 0.2333 | 6.083 |
| Adjusted $R^2$ | 0.3935 | | 0.3477 | |

## 3.7 Summary of results

The findings from the self-questionnaire survey, observation, and discussion suggest that there are various risky behaviours associated with motorcycle driving, including speeding, not wearing helmets for short distances, neglecting to check vehicle conditions, using a phone when riding, and riding against traffic flow. The training workshop was found to be effective in reinforcing safe driving attitudes and behaviours, but some students still did not pay attention. The road safety audit was found to be an effective motivational intervention that can raise risk awareness and encourage safe driving behaviours.

The study also found that risk awareness and knowledge score significantly affect risky behaviour. Students who gained more knowledge about road safety and had higher risk awareness tended to behave in a safer manner. Additionally, past behaviour had a significant positive influence on current behaviour, suggesting that past riding behaviour can predict their intention to drive safely or unsafely.

Based on the lessons learned from observation and discussion, safety education programme can be more effective if it is tailored to the specific needs of the group. This can include small

group sizes, short training sessions, regular and continuing education, a variety of activities (including outdoor activities), and safety training as part of the school program by school staff.

Overall, the study's findings suggest that targeted and effective safety education programs can encourage students to adopt safe driving behaviors and reduce risky driving behaviors.

# CHAPTER 4 Conclusions and Suggestions

Road safety education is a essential tool for promoting safe behaviour and reducing road crashes. However, it should not only provide knowledge of traffic rules and driving skills, but also influence attitudes and perceptions toward risk awareness. New design of methods is needed to be more effective in motivating these targets.

The focus of this research is to design a road safety education program that encompasses various knowledge, skills, and training to achieve the desired goals. The aims of this research were to (1) to educate students on road safety assessment and basic engineering design, and (2) to allow students having experiences in auditing road safety and redesigning safer routes to school. (3) to stimulate critical thinking on road safety, leading to increased risk perception, and safe driving behaviour.

Based on the literature review conducted in this research, multiple design strategies have been identified, including:

- Incorporating integrated knowledge in learning sessions, covering topics such as road safety, safe systems, Hiyari Hatto, and basic engineering design based on the principles of road safety audits,
- Including road safety audits as a participatory activity, allowing students to engage in role-playing activities as auditors, and
- Evaluating the performance of these activities through the measurement of changes in levels of knowledge, attitudes towards risky behaviour, and intentional behaviour.

Two case studies were conducted in different provinces of Thailand, Suphan Buri Technical College located in Suphan Buri province, and Prince of Songkla University (PSU) located in Songkhla province. The participants of the activity were between the ages of 15 and 22 and were students at these institutions.

The key findings of this study are as follows:

- Several risky factors were identified, including speeding, not wearing a helmet for short distances, and modifying motorcycles. Addressing these factors is critical for increasing risk awareness and promoting safe driving behaviour.
- Integrating road safety education with engineering design can serve as a motivational intervention that reinforces attitudes, perceptions toward risk awareness, and intentional behaviour of road users and drivers, leading to safer road behaviour. This approach can

also help students better understand the impact of road infrastructure on their safety and how they can contribute to promoting safer road design and operation.

- Although road safety education can positively influence attitudes, risk awareness, and intentional behaviour for greater safety, past behaviour is one of the key factors that influences safe driving behaviour in the future. For individuals who have engaged in unsafe behaviour, educational interventions alone may not be sufficient to change their behaviour, and additional measures may be required.

Furthermore, the study suggests the need for effective road safety education for children and youngsters in Thailand, which should be integrated into every level of the school program. This would help to create a culture of safety and promote safe driving behaviours among young people, which is crucial for reducing the number of road accidents and fatalities.

Future research could investigate the current state of road safety education in schools in Thailand and compare it with case studies from other countries, such as Japan. This could help identify best practices for promoting road safety education among young children in Thailand.

Additionally, research could focus on designing a continuing process of road safety education for students, particularly for those who have low risk awareness and engage in risky riding behaviour. This could involve developing targeted interventions and strategies to engage and motivate these students to adopt safer driving behaviours over time.

# References

Assailly, J.P. (2017), Road safety education: What works?, *Patient Education and Counseling*. 100S, S24–S29.

Chou, C. C., Yoh, K., Inoi, H., Yamaguchi, T., & Doi, K. (2022). Effectiveness evaluation on cross-sector collaborative education programs for traffic safety toward sustainable motorcycle culture in Vietnam. *IATSS research*, *46*(2), 258-268.

Lankarani, K. B., Heydari, S. T., Aghabeigi, M. R., Moafian, G., Hoseinzadeh, A., & Vossoughi, M. (2014). The impact of environmental factors on traffic accidents in Iran. *Journal of injury and violence research*, *6*(2), 64.

OECD-ECMT (2008) Towards Zero: Ambitious Road Safety Targets and the Safe System Approach, OECD Organisation for Economic Co-operation and Development; ECMT European Conference of Ministers of Transport Paris.

Ratanavaraha, V., & Jomnonkwao, S. (2013). Community participation and behavioral changes of helmet use in Thailand. *Transport policy*, *25*, 111-118.

ROSE 25 project (2005) Good practice guide on road safety education (Inventory and compiling of a European good practice guide on road safety education targeted at young people), TREN/E3/47-2003 SER-B27020B-E3-2003-Good Practices-S07.28326, ROSE 25 [project funded by the European commission].

TRL (1997), Road Safety Education in Developing Countries Guidelines for Good Practice in Primary Schools, Transport Research Laboratory (TRL), UK.

# Final Report

Research Grant 2022

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