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Research paper

Computer Games as Learning Tool towards Children Road Safety Education

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Abstract

Road safety awareness is one of the many awareness programs that are often highlighted and discussed around the world. The road accident statistics are increased due to the lack of exposure and awareness among communities about traffic environments and rules. Children are one of the most vulnerable populations involved in traffic accidents. The children are unable to familiarize themselves with the surroundings, especially when crossing the road. This research attempts to improve road-safety awareness among children by using computer games as a learning tool. Specifically, it determines the progress of knowledge on the road rules and conditions after the children using the tool. The computer online game is suitable methods to use for teaching them on road safety due to interactive application always intimate the children. Besides the survey questions that related to road traffic rules, we also measures the attitude towards road safety in the participant (i.e., children and adult). Descriptive analysis in frequency, mean, and percentage are used to describe the respondent's information. Statistical Package for Social Science (SPSS) is used to analyze the findings. The overall findings show that all respondents have positive feedback on online games as a road safety tool. Interestingly, the significant output shows on the different knowledge about road safety when the children are analyzed for before and after they played the games. The future research is suggested to study the other group of participant as the respondent in this work is limited to the primary school children. It can be improved by involving the large sample size and wider location.

Keywords: *Road-safety Awareness, Online game, School Children, Survey and Questionnaires*

1. Introduction

Road accident is one of the many issues that are often discussed and become hot topics around the world. The accident had a great impact on the population of a country where the road accident resulted in injuries, deaths and property deterioration. The authors in [1] had categorized victims of accidents to several features such as minor injuries, serious injuries and deaths. There are difference between road victims with other countries is reported through mortality rates per unit of population or death rate per vehicle [2, 3]. The children are one of the most vulnerable populations involved in traffic accidents as pedestrians [4-6]. The pedestrians face risks when crossing the road where they are likely to be hit by car or motorcycle on the road. This is due to lack of knowledge and behavior that make them involved in road accidents. It has become one of the threats to the population of children.

In Malaysia, the number of road accident deaths increased in every year. In 2016, there are 7152 total people were killed in road accidents compared to the 6706 deaths recorded in 2015 [7-10]. It reveals that the highest number of deaths was recorded in 2016 for within 10 years. The Malaysia government is committed to overcome the road safety issues by establishing Road Safety Unit [10, 11] that managed under the Ministry of Transportation. The main role of the Road Safety Unit is to provide exposure and understanding for road users by educating and raising the level of road safety awareness. Such goals are achieved through various implementations such as media campaigns, educational programs and others. Meanwhile, the Health Education Department, the universities, and non-governmental organizations (NGOs) such as Petronas, Petron, and Shells are also contributing for promoting the road safety education programs to raise awareness and knowledge for parents as well as children. For example, Programs Based Community [12] is a program in the rural areas that provides exposure on the use of helmets and seatbelt. There are many other activities, training and programs [13-16] that exist to provide road safety knowledge and awareness among the children.

In the era of information technology (IT), young people (i.e., teenage, children) are intended to learn further new through Internet. For example, the children have a strong attraction to such technology especially by using gadget and computer. The Internet is one of the most common field are used nowadays for educational purposes. Lately, activity through computer/Internet at school is a major change in the learning process [17, 18]. As seen today, the children have ability to use computers since in their early stages of childhood. Computer game education further is able to provide better knowledge as well as skills because the children are expected very attracted on it. By that sense, such medium enable children to understand more about some aspects.

In learning of road safety, the use of computer is significant to ensure the knowledge can be converted to experience. Therefore, this study provides a survey mechanism towards road safety education among primary school students through online game. It measures on how does the road safety online games are able to improve road safety awareness among children. We build several set of study questions to analyze students' feedback towards road safety online games that they are played. The remainder of this paper is organized as follows. Section 2 describes related work on road safety education using IT. Section 3 details the instrument in

regard the type of survey questions used for the study. Research design and our finding from the survey is presented in Section 4 and 5, respectively. Finally, Section 6 concludes the paper.

2. Related Work

Road accidents are one of the major problems in many countries around the world. Road accidents are increased in every year. According to a study in [19] children aged 9-12 years are the most populaces that involved in road accidents. Compared between 2007 and 2016, the percentage of deaths among children due to road accidents increased between 3-10% in all level of ages. In year 2007, children aged 6-12 year as a pedestrians were the highest death victims' rate with 60% followed by 20% cyclists. Approximately 60% of the total pedestrians involved in road accidents are school children and 13% occur on students who commute from school. Children are more likely to get involve in traffic accidents due to immature physical and mental development. Furthermore, with small physical conditions it causes more severe injuries.

In Malaysia, the awareness on road safety among children can be considered significant towards more responsible person when they grow-up. It is due to several reasons such as llimited mental development, physical and psychomotor development of children causes them exposure to risks and dangers while on the road. The road safety education needs to be nurtured among children started at the pre-school level. Early exposure to road safety education can reduce the risk of road accidents. According to the authors in [5], the school children who have knowledge about road safety have positive attitudes towards road safety and this situation can reduce the risk of accidents among school children. The authors in [10] stated that children's behaviour problems are trivial variables that involved in accidents compared to pedestrians and cyclists. Meanwhile the author in [16] claimed that there was no correlation between behavioural problems, knowledge and attitude among primary school students on road safety which led to road accidents. In other researchers discovered that the knowledge on road safety does not necessarily influence behaviour among primary student [8, 9]. Obviously, the knowledge on the road safety is not enough for being safe in the road. They needed to be assisted with experience-based behaviour towards road situations.

An effective road safety education program is necessary not only for children but parents. All the road users needed to play role in educate and aware about the risk and dangerous that can occur in the road. For example, the children need a thorough supervision from adults while on the road. High rates of accidents among pedestrians are reported involving children between 5 to 12 year old [10] due to lack of knowledge on road safety and guidance on how to continuously safe in the road. Therefore, adult specifically parents should show good example to their kids on responding to the road rules and conditions.

Normally, the road safety education is established by using oral-delivering approaches (e.g., seminar, discussion) among communities. Children are easily to understand something through visual and animation compare to oral education. For tackling the young kids attention, schools; more specifically teachers are requires to use interesting techniques in delivering the road safety education. The use of IT has already begun by children from the age of 2 years. These children are exposed to technology by their parents through gadgets and computers. Along with the development of current technology, the school also needed to utilize such technology approaches in education [17]. One way to approach the children for focusing on the road safety education is through computer game. The computer games can improve cognitive, motors and skills, further help in learning through playing the games. Implicitly, they can learn about principles, rules and concepts that are invisible in reality. Normally, the computer games composed of graphics and animations that presenting the elements such as rules, goals, challenges, fantasy, mystery, competitions and evidence [20]. It also provides a challenge situation with conflict those forces by other players, computer intelligence and risky game rules. By using the animated computer game it helps to improve the cognitive development of children while giving them experience-based imitation [17, 20].

The online games can be used as a one of alternative method to make easier for children to understand on road safety. The computer-based learning games can help children learn something in fun situations. It can further improve the skills of an aspect for example is road safety. In order to enhance the road users' skills in understanding about the road safety aspect, the Road Safety Unit (JKJR) initiates the development of the online computer game application. The available online games from the unit's web site [21] aim to educate road users in interesting way but knowledgeable. Therefore, the purpose of this study is to determine the effectiveness of online game towards road safety education while investigating on how well the game able to improve the safety awareness in children.

3. The Survey Instrument

The road safety education is one of the government's steps in reducing the road accident risks leading to death, injuries and damage to property. Through the road safety education, it can provide knowledge and change the behaviour of road users to be more prudent while using the road. The purpose of Road Safety Education in primary school is to provide basic knowledge and skills about road safety to produce a prudent generation of road users. In addition, students can understand, appreciate and practice the safeguard measures of self-protection and respect the rights of other road users.

Meanwhile, the computer games can bring good effects to children. The controlled environment towards playing the computer games, especially education-based computer games are able to contribute in children's cognitive skills. Therefore, computer education is a potential learning method for children to prevent them from getting bored. This study is conducted among teachers and primary school students. Hence, the feedbacks and responses can be assumed accurate as there are the 'real' road users. There are other researchers that also study and explore on this topic e.g., in [7, 16, 19], however they covered different perspectives in educating the school children while providing awareness towards road safety.

This study is used the questionnaire survey as a one of instrument to collect the data. The questionnaires are designed and defined in prior as the series of question that aim to gather prompt and accurate information from respondents. Therefore, in order to perform a good research, a good questionnaire must be designed. Basically, the questionnaire is designed contains four basic question-responses format which are open, closed-ended, scale response and opinion type of question. In this study, closed-ended questions will apply because it might save the respondent's time and effort when answering the questions. The questionnaires presented in three-Point Likert-type scales [22] and dichotomous questions which make it easier for the respondents to choose the desired answer.

The set of questionnaires for students are provided through written paper. It is where we brought the questions papers to the school and asked them to answer within respective time. There are two sections in the set of question as follows.

Section A: Background of the Respondents

This section is about general questions regarding the background of the respondents. It aims to know better about the respondent background in the study. This part gathers the students demographic background such as gender, age and way they coming to the schools.

Section B: Road Safety Knowledge

The survey for this section is investigated for two different of scopes is knowledge about road sign and knowledge toward road safety policies and rules (Table 1). We prepared two types of tests are Pre-test and Post-test. The Pre-test questions will give before respondents are played the online games and the Post-test questions will give after they played the games. Particularly, in both tests the students will be received the questions for both scopes. In response to the two-way test methods of investigation for this section, we designed the questionnaires where consist of 11 questions differently. The distribution the questions in regards the scope and test method are given in Table 2 and 3. The different in questions distribution for both scopes due to we concern on the level of difficulty of memorizing policies and rules compared than the road sign. It means that the students are required to aware on the right road rules after they played the online games.

For implementation in the two-way test mechanisms, they are given respective duration where in our survey 30 minutes are allocated for them to answer the Pre-test questions. Then there is 5 minutes break before they allowed using the online road safety games. The duration for playing the games is also 30 minutes. For a second time, they are given 5 minutes break before seat for the Post-test questions again for another 30 minutes. They then need to hand-over the question papers.

Table 1: Scopes for Section A

Scope	Details
Road sign identification	Related the knowledge about road sign which are very commonly used on street.
Rules and attitude on road	Related the user behavior on the road.

Table 2: Distribution of the Questions in Pre-test

Scope	Question Number	Total
Road sign identification	1, 2, 3, 4, 5, 6, 7	7
Rules and attitude on road	8, 9, 10, 11	4

Table 3: Distribution of the Questions in Post-test

Scope	Question Number	Total
Road sign identification	1, 2, 3, 4, 5	5
Rules and attitude on road	6, 7, 8, 9, 10, 11	6

Section C: Online Games Experience

This section aims to get feedback from the students in playing the computer games that about road safety. Hence, these questions are distributed after the students played the games. There are several affective dimensions that we concern in order to assess their experience and feedback towards the road safety games. They are the dimension of reaction, interactivity, learning and interface. Such dimensions are very important where to identify the students' satisfaction in learning through the games and how well they improved the road safety knowledge (Table 4). This section of consist 20 questions. For sake of accuracy, we designed the questions with respective distribution (Table 5) where each allocated total number of questions in regards the dimensions is defined based on the level of significant in achieving the study objectives. Each question needed to be answered either "X" (i.e., False) or "√ "(i.e., True). The respondent needs to choose one answer only.

Table 4: Dimension towards Experience in Playing the Games

Affective Dimension	Description
Skill	Related to the tendency of using computer
Reaction	Related to the feeling with the game such as fun, happy, bored and relaxing.
Interactivity	Related to interactivity between users with the game where the functionality on the game will be considered. Such as ways to understand and use the instructions on the game.
Interface	Related to the screen such as size, animation, and color.
Learning	Related the knowledge based on the games. Such as putting effort and try hard to do it well.

Table 5: Question Distribution According to the Dimensions

Dimension	Question Number	Total
Skill	1,2,3	3
Reaction	4,5,6	3
Interactivity	7,8,9	3
Interface	10,11	2
Learning	12,13,14,15,16,17,18,19,20	9

4. The Research Design

This study used a quantitative approach where using survey method to collect the data. According to [16], survey method is common used in the research when the analysis unit is human individual. In this section we describe in details process in survey method that used for the study.

4.1. Sampling

The sampling in the survey method is important in order to achieve accurate answer. It is where the sampling must be met with the objective of the study and matched with the designed questionnaires. In particular, this study involved primary students and teachers from primary school located at Serdang. There are 30 respondents from primary students at age 10 and 11 year-old. We used the school computer lab as the location for investigating the online game as the learning tool. The students will be accessed to the Internet in order to play the road safety online game.

4.2. Tools

This research used Road Safety Flash Games that developed by the Road Safety Unit (JKJR) [21]. Due to there are many types of games to learn about road safety (about 28 Flash Games), we only selected 12 games (Table 6) to use in this study. It is because such 12 games are suitable to play by the primary school pupils where it is easy to play and understand.

Table 6: Flash Games Road Safety for the Study [21]

The Game Name	**Description**
Signaster	Knowledge on road sign identification and attitude on the road
Road wordy	
How fast can u be	
School Cross	It is about the rules of the pedestrian
Parking	It is about the vehicles parking rules
Gokart	It is about rules of car on the road such as speed, condition, sign board and others.
F2	
Drivesafety	
Ride life	
Valentines	Related to the driving behaviors on the road
Drosy	
Stay alert	It is about awareness and safety alert when using the road

Data that collected are be analyzed by using Statically Package for Social Science for Windows (SPSS). Descriptive method is used to analyze the data. Such descriptive statistic is used to compute

the mean (N), percentage (%), standard deviation, maximum and minimum of the score.

5. The Finding

The Section A studied on the students' background that that contains name, class and ways come to school. Based on the name of respondent we determined their gender and the class provides information about their ages.

Table 7: Student Background

Antecedents Variable	N (%)
Age	
10 years	15(50)
11 years	15(50)
Gender	
Male	22(73.3)
Female	8(26.7)
Ways come the school	
Bus	5(11.1)
Car	23(51.1)
Walking	1(2.2)
Motorcycle	13(28.9)
Bicycle	3(6.7)

From the analysis there are 22 boys (73.3%) and 8 girls (26.7%). For the information on how they comes to school, there are more than 50% of them are sending using cars while others in variety of transportation. Merely 2.2% of students are walking to the school. In Section B we have two subsections where first, to measure knowledge about road signs identification and, second, to evaluate the knowledge on road policies and rules. In response to that, we used 2 test methods are Pre- and Post-test where students should answer the questions before and after they played the road safety computer games. As we can see from the Figure 1 below, there is increased in the correctness answer from the students after they played the road safety online games. Each the correct answer is given 1 mark point. For the Pre-test, there are none of students able to answer correctly in question number 11 but it is increased to 23.3% of students that able to answer it in the Post-test. There are 0% of marks for the questions number 1 to 5; it means that all students are able to reach more than 5 mark points in both tests. Interestingly, in the question number 9 in the Pre-test there are majority of students able to get the correct answer, where it is about the traffic light colors. Note that, due to the traffic lights are the road entity that commonly find in the road; hence it is easy to remember and recognize.

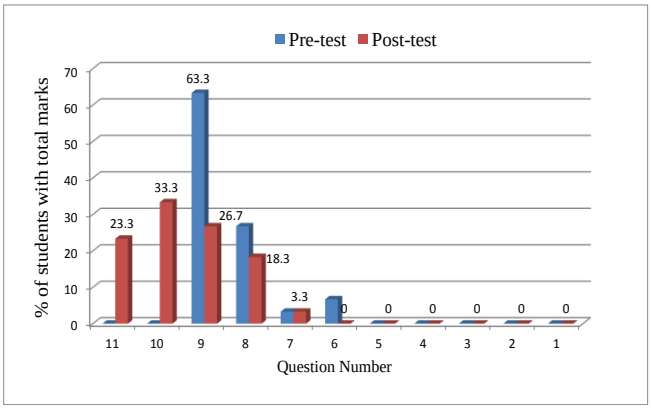

Figure 1: Comparison between Pre-test and Post-test Based on the Total Marks.

In the Section C, the survey questions are aim to analyze student experiences towards the games. It is measured according to the four dimensions (Table 8). Based on the dimension of their experiences shows in Reaction dimension there are majority students (96% on average) feel happy and relax when playing the games. For Interactivity dimension, there are 14 students (46.7%) replied difficulty in played the online games while almost majority of them (76.7%) feels the instructions are not clear and difficult to understand. During the survey, we help in order to make them understand on how to play the games. Hence, we concluded that the games need some sort of improvement in order to make the games easy and able to play/use by the young students. In relate to difficult to understand the game instructions, it leads 16 students (53.5%) does not know how to play.

Meanwhile, most of the students are adore the design and interface of the games where 27 students (90%) response interesting and 26 students (86.7%) like with design on the game interface. Interestingly, at the Learning dimension, majority of students show positive standpoint towards awareness, knowledge and benefit. Meanwhile, more than 80% students replied that the game trigger their mind and reaction towards the important of road safety education. In conclusion, the study finds that majority all students give a positive reaction towards the online games.

We also conducted additional survey on student feedback towards road safety education. The feedback are divided according to 3 scopes are perception on road safety online game, user satisfaction and children awareness toward road safety attitude. From the result (Table 9) majority of respondent have high perceptions on road safety online game, satisfies and awareness towards road safety. It is due to they have positive standpoint on using the games as part of learning tool in current trend. Furthermore, students show positive perception of the road safety where majority of them used the road every day, and during mess and peak hours. This is a very important to improve their awareness towards safety rules and policies when on the road.

Table 8: Experienced Using the Games

Dimension	Quantity	Percentage
Reaction		
Happy	26	96.7
Relaxing	27	90
Bored	3	10
Interactivity		
Difficult	14	46.7
Understand instruction?		
Yes	7	23.3
No	23	76.7
Ways to use?		
Yes	14	46.7
No	16	53.5
Interface		
Interesting	27	90
Design (color, animations , size)	26	86.7
Learning		
Awareness	30	100
Knowledge	30	100
Benefit	28	93.3
Mind test	27	90
Challenge	26	86.7

Table 9: Perception and Feedback from the Students

Feedback Scope	Moderate N(%)	High N(%)	Total
Perception on road safety online games		30 (100)	High
User satisfaction	1(5.5)	29 (95.0)	High
Attitude towards road safety online games		30 (100)	High

6. Conclusion And Future Works

From the finding results, we can see that the computer games on road safety give the benefits among the student to improve their knowledge about road. The students easy to understand and memorize when using the games as it gives relax and excitement experiences. It might be because the students more focus on something visual compared than theories. Based on the games that is used as part of learning tool it will help students to be more aware of road rules and policies. Meanwhile, the games also educate the school children the dangerous that causes by the road if they are lack of knowledge and less focus in using the road. We hope from the study that been conducted it can be used for future reference and a competent module for road safety education.

Parents and community can also involve in this survey in the future for sharing such interactive approach in educating their young children. They can use the games at the home in order to further increase their children awareness towards road safety. More other games can be created such as awareness of stranger, home alone safety, report the annoyance etc. It might be a suggestion to the government (i.e., the Road Safety Unit JKJR) and non-government organisations to create more games and provide in online as a free education games.

This study involves merely small number of respondents and the result cannot used to judge as a majority outcomes. Hence, for the near future the study is suggested to scale up the respondents for reaching validity and accuracy purposes. Furthermore, this studies just to investigate on how the games act as the effective learning tool. In the near future, we also intended to investigate on how the games change the school children behaviors.

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References

[1] R. P. Road Safety, C. Education, U. Monash, and O. Conference Management, "2001 Road Safety, Research, Policing and Education Conference : proceedings : regain the momentum : Hilton on the Park, Melbourne, Victoria : 18-20 November 2001," Clayton, Vic.

[2] S. Hakim, D. Shefer, A. S. Hakkert, and I. Hocherman, "A critical review of macro models for road accidents," Accident Analysis & Prevention, vol. 23, pp. 379-400, 1991/10/01/ 1991.

[3] W. H. Organization, Global Status Report on Road Safety: Time for Action: World Health Organization, 2009.

[4] de Blaeij, R. J. G. M. Florax, P. Rietveld, and E. Verhoef, "The value of statistical life in road safety: a meta-analysis," Accident Analysis & Prevention, vol. 35, pp. 973-986, 2003/11/01/ 2003.

[5] E. Towner, "Child Development and the Aims of Road Safety Education—A Review and Analysis," By J A Thomson, A Tolmie, H C Foot, and B McLaren. (Pp 131; £19.00.) Department of Transport Road Safety Research Report No 1. Norwich: HMSO, 1996. ISBN 0-11-551-797-9., vol. 4, pp. 79-80, 1998.

[6] Eshaghabadi and S. Sahab Negah, "Road safety education for children," Neuroscience journal of Shefaye Khatam, vol. 3, pp. e44-e44, 2016.

[7] M. N. Mustafa, "Overview of current road safety situation in Malaysia," Highway planning Unit, Road Safety Section, Ministry of Works, pp. 5-9, 2005.

[8] H. Hizal Hanis and S. Sharifah Allyana, "The construction of road accident analysis and database system in Malaysia," in 14th IRTAD Conference, 2009, pp. 16-17.

[9] M. F. M. Yusof, N. Nor, and N. A. Mohamad, "Malaysian value of statistical life for fatal injury in road accident: A conjoint analysis approach," Journal of Society for Transportation and Traffic Studies, vol. 2, pp. 30-40, 2013.

[10] N. Mohamed, W. S. Voon, H. H. Hashim, and I. Othman, "An overview of road traffic injuries among children in Malaysia and its implication on road traffic injury prevention strategy," 2011.

[11] (Road Safety Planning Malaysia 2014-2020). http://www.jkjr.gov.my/ accessed on 25 Jan 2018

[12] https://www.shell.com.my/sustainability/communities/road-safety.html accessed on 1 Jan 2018

[13] Subramaniam, C. J. Zehnder, G. Anbumuthu, M. A. bin Abdullah, N. Subramaniam, and M. P. Chelladorai, "Corporate Management and Sustainability (Shell versus PETRONAS)."

[14] T. Fossgard-Moser, "Social performance: key lessons from recent experiences within Shell," Corporate Governance: The international journal of business in society, vol. 5, pp. 105-118, 2005.

[15] R. Radin Umar, "Motorcycle safety programmes in Malaysia: how effective are they?," International journal of injury control and safety promotion, vol. 13, pp. 71-79, 2006.

[16] M. I. Shahrimin, S. H. Labulla, K. S. Hua, and T. W. Nie, "Background Differences of Parental Attributes: A Case Study of a Preschool Road Safety Education Programme in Perak," Editorial Board, p. 11, 2012.

[17] N. A. A. Bakar, A. N. Zulkifli, and N. F. F. Mohamed, "The use of multimedia, Augmented Reality (AR) and Virtual Environment (VE) in enhancing children's understanding of road safety," in Open Systems (ICOS), 2011 IEEE Conference on, 2011, pp. 149-154.

[18] R. Sutherland, V. Armstrong, S. Barnes, R. Brawn, N. Breeze, M. Gall, S. Matthewman, F. Olivero, A. Taylor, and P. Triggs, "Transforming teaching and learning: embedding ICT into everyday classroom practices," Journal of Computer Assisted Learning, vol. 20, pp. 413-425, 2004.

[19] N. A. C. Zakaria, "Road Safety Level: A Case Study of Major Road Linked Terengganu and Kuantan Town," UMP, 2010.

[20] N. A. Rawi, A. R. Mamat, M. S. M. Deris, M. M. Amin, and N. Rahim, "A Novel multimedia interactive application to support road safety education among Primary School children in Malaysia," Jurnal Teknologi, vol. 77, pp. 75-81, 2015.

[21] http://jkjr.gov.my/ms/bilik_media/permainan-keselamatan-jalan-raya-flash-games.html.

[22] J. Munshi, "A method for constructing Likert scales," 2014.