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Comparative Analysis of R2S Platform among Developed and Developing Countries

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Abstract

This study examines six separate studies conducted in different countries to evaluate children's awareness of road safety. The studies encompass a diverse range of countries, including both developed and developing nations, providing valuable insights into the issue. The research highlights the significance of addressing road safety, particularly in developing countries with inadequate infrastructure and low awareness leading to higher accident rates and fatalities. Demographic characteristics of the participants are considered to ensure the generalizability of the findings. The study also analyzes five-year traffic accident data, emphasizing the need for more effective measures to reduce accidents and fatalities, particularly in developing countries. Additionally, the study compares approaches taken in developed and developing countries, evaluates the effectiveness of the R2S platform in raising awareness among children, and provides feedback and suggestions for improvement. Although the platform has limitations, it effectively raises awareness about traffic safety among children. The study concludes with recommendations for enhancing the platform's learning experience, expanding its age group, improving user-friendliness, and incorporating feedback from researchers.

1. Introduction

Road safety education was crucial for children's learning, particularly in developed nations. Schools have conducted studies using scenario-based questions and virtual reality to teach students. Studies indicate that young children are more vulnerable to pedestrian accidents, resulting in significant harm and fatalities (Zegeer and Bushell, 2012). Therefore, various road safety education programs were introduced in different countries to raise awareness among ongoing children.

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In recent times, not only have digital games and visual effects highly engaged children (McGonigal, 2011a), but e-learning platforms have also been found to improve learner engagement and performance, particularly in traffic safety situations (Krause et al., 2015). Moreover, e-learning platform in education motivates students by making learning more enjoyable while increasing active participation. It also offers clear goals and feedback which allow them to learn from their mistakes and make necessary improvements. It also provides a sense of progression and creates an engaging and interactive learning environment. When implemented thoughtfully, these digital platforms can improve student engagement and performance, ultimately enhancing the learning experience.

As a result, various online platforms have been developed in different countries to raise awareness of safety among children. For example, the Safeway2School project, funded by the EU, developed an integrated system that uses Intelligent Transport to safely transport children from their homes to school (Jankowska-Karpa and Wacowska-Ślęzak, 2017). Moreover, various road safety education programs were implemented in different countries i.e. Spain (Alonso et al., 2018), Nederland, France, Great Britain, Scandinavian countries (Dragutinovic and Twisk, 2006) and Skills for preventing injury in youth (SPIY) (Buckley et al., 2010) in Australia.

Due to the advancement of technology and access to the internet in every house, online road safety platforms have become more effective in raising awareness among children. For that, the Institute of Mobility Uhasselt has developed a Route 2 School platform (Riaz et al., 2019) to implement in elementary schools. As a result, the children took it more user-friendly and also increased the awareness of road safety among children. It mainly consists of four modules, i.e., knowledge, risk detection, risk assessment, and situation awareness. After the platform's success, it was implemented in different developing countries, i.e., Vietnam, Indonesia, Palestine, and Pakistan, according to their characteristics.

The study's main aim is to have a comparative analysis of the R2S platform, which is being tested in developed and developing countries, to know the platform's strength and weaknesses. Moreover, this study will also analyze the similarities and differences among the tested countries and how they can be improved in future countries. In order to make the R2S platform more feasible in the future for all the countries, the detailed analysis of the platform that include modules is necessary and for that this study is important to be carried out. Moreover, the comparative study among the R2S platform in tested countries was carried it in this research. It compares the platform implemented in developed country and the develping countries. How the children react in both the countries and what will be the recommendation for the further studies that is going to be implemented in other parts of the world. Overall, this study analyzes the R2S platform and their results critically and how it can be improved in the future. What things can be added to make it more user friendly for the children? Moreover, the Limitation of the platform is also discussed in this research.

2. Methodology

The study was about comparing the R2S platform among developed and developing countries. About six studies related to the R2S platform were selected in this study. One was from the developed country, Belgium, and others were from the developing countries where the platform was tested. Most of the studies gathered from the developing countries were the thesis of Master students from Uhasselt except the Pakistan study.

Initially, the studies were compared based on their similarities and differences among the developed and developing countries. It includes the target population, the use of control and experimental groups, familiar and unfamiliar situations, and the inclusion of pre and post-questionnaires. In addition to this, the study also revealed the strengths and weaknesses of the R2S platform used in the selected studies. It was analyzed based on the suggestions given by the participants in all the studies. Lastly, the critics and suggestions were discussed, which were gathered from all the studies. The Excel sheet was made in which the summary of all the studies was incorporated and compared between them.

2.1. R2S tested studies

About six research has been done in different countries to test the awareness of children about road safety. Two were conducted Indonesia (Putri, 2020; Sitohang, 2021), One in Palestine (MAYALEH, 2021), one in Vietnam (Pham, 2019), one in Belgium (Riaz et al., 2019) and one in Pakistan (2022). Majority of the countries where this

platform was tested were developing countries except Belgium. Majority of the studies were done by the Master student for their thesis except the Belgium study which was done by (Riaz et al., 2019) and Pakistan study which is in process of being published. Below table shows the research done in different countries.

Table 1. Studies done about R2S platform

Author	Year	Title	Country + City
(Riaz et al., 2019)	2019	Evaluation of a gamified e-learning platform to improve traffic safety among elementary school pupils in Belgium	Belgium, Hasselt
(Pham, 2019)	2019	Application of the gamified e-learning platform to improve road safety education in Vietnam	Vietnam, Ho Chi Minh
(Putri, 2020)	2020	Application of the Gamified E-Learning Platform to Improve Road Safety Education in Indonesia: Case study of Jakarta	Indonesia, Jakarta
(MAYALEH, 2021)	2021	Study the R2S Education Platform in case of Palestine	Palestine, Nablus
(Sitohang, 2021)	2022	Understanding the support of route2school (R2S) education implementation in Indonesia	Indonesia, Jakarta
Imran Nawaz	2022	Exploring online traffic education in Pakistan: A case study among adolescents of Lahore	Pakistan, Lahore

2.2. Study Demographics

This comparative study examines the demographic characteristics of participants in order to better understand the population being studied and to ensure that the findings are applicable to a wide range of individuals. The study mainly includes the children going to school on the own either on foot or via motorbike. The minimum age of the child used in these studies was 9 years old and maximum was 18 years old. Majority of the study include male children as their target group especially in developing countries while the Belgium (Riaz et al., 2019) have more proportion of female children as compared to male. The maximum target group was 223 participants in Vietnam (Pham, 2019) whereas the minimum participants were in Indonesia (Putri, 2020) that is 57 while understanding the implementation of R2S platform. Nearly the ratio of completing all the module was not 100% in all the six studies.

3. Results

3.1. Traffic accident data of each country

Table below shows the five-year traffic accident data of all the six countries where the R2S platform were tested. Vietnam (General Statistics Office of Vietnam, 2022) and Indonesia (Ministry of Transportation, 2022) shows the accidents and the fatalities rates in per 1000 population whereas the other three countries Palestine (PCBS, 2022) Belgium (OECD, 2022) and Pakistan (Bureau of Statistics, 2022) shows the overall traffic accident data and fatalities. In underdeveloped countries, hospital-based data and police records are the most common sources of injury information (Asogwa, 1992; Balogun and Abereoje, 1992; Bangdiwala and Anzola-Pérez, 1987; Jayasuriya, 1991; Mohan and Bawa, 1985; Oluwasanmi, 1993; Weddell and Mcdougall, 1981). These sources, however, underestimate the burden since they routinely under-report and capture only the most severe occurrences of injury (Smith and Barss, 1991). Therefore, in developing countries like Indonesia, Pakistan whose Population is very high having a smaller number of reported accident rates and causalities. The fatality rate of Belgium is less than 2% as compared to the other developing countries shows how quick the emergency services performed in developed countries and advanced health facilities decreases the fatalities rate.

Table 2. Traffic accident data of each country

Fatalities			2015	2016	2017	2018	2019	2020
Vietnam	Accidents	Per 1000s	22.85	21.43	20.08	18.74	-	-
	Fatalities		8.73	8.64	8.28	8.21	7.62	6.86
Indonesia	Accidents	Per 1000s	-	-	104.33	109.22	116.41	100.03
	Fatalities		-	-	30694	29472	25671	25266
	Injuries		23937	20075	14559	13315	12475	10751
Palestine	Accidents		8985	10630	11541	12829	13165	10977
	Injuries		8673	9447	9316	9561	10968	8629
Belgium	Accidents		40300	40123	38025	38453	37719	30251
	Fatalities		762	670	609	604	644	499
Pakistan	Accidents		9100	9582	11121	10779	9701	10429
	Fatalities		4448	5047	5948	5932	5436	5816
	Injuries		11544	12696	14489	13219	12317	12886

3.2. Comparison among developed and developing countries

The study also made the comparison among the developed and developing countries. It revealed that the target group varies among the developed and developing nations. Also, the Belgium used only one group data for collection whereas developing countries use pre and post intervention studies. However, there are some similarities such as they used the same R2S platform to collect the data, and the data was collected at the end of the academic year. Also, the sample size was not that large according to the population of the countries. Lastly, the ratio of female children was more in developed nation as compared to the developing. Table 3 shows the similarities and difference among developed and developing countries.

Table 3. Comparison among developed and developing countries

Sr. No.	Similarities	Differences
1	The Belgium first developed the R2S platform containing 4 modules Knowledge, Risk detection, Risk Management and Situation awareness and the developing countries followed the same R2S platform in their studies	The target group in Developing countries studies ranges from 9 years to 18 years old whereas the target group in Belgium ranges from 9 years to 13 years old
2	Both the Belgium study and the Asian study except Pakistan uses the familiar and unfamiliar situations in the platform	The Belgium research used only the one group for data collection whereas the control and experimental group have been used in some of developing studies
3	The data collection time for the study was same (end of academic year) in both the developed and developing countries.	The Belgium study only focus on the pedestrian and cyclist who are going to the school whereas most of the developing countries focus on the cyclist and motorbikes as they don't have special pedestrian path.
4	The sample size was small and did not target the whole target population of the city in both case studies.	The pre and post intervention questionnaire along with online feedback survey was used in developing countries whereas no such pre and post intervention was used in Belgium case study.

| 5 | In both the case studies, the footage was collected on different traffic scenarios and only picture was taken instead of videos. | Students in Asian countries performed worse in Situation awareness module whereas the students of Belgium performed better in all the modules showing that they have good knowledge of traffic safety education. |

3.3. Strength and Weaknesses about R2S studies

The online platform for traffic safety instruction offers several advantages, but it also has some shortcomings that can be addressed. One of the platform's benefits is its capacity to create awareness among children about traffic safety, which is critical in preventing road accidents. However, the platform's effectiveness is limited because it relies solely on pictorial representations of traffic situations. Incorporating video or even 3D/VR technology can improve and enhance the learning experience. Furthermore, the platform is commendable in that it covers all aspects of traffic safety in four modules: knowledge, risk detection, risk awareness, and situation awareness. However, the platform only caters to a specific age group, leaving out other age groups who could benefit from it. While the platform provides feedback after each question, there is no mobile app that can be adapted to make it more user-friendly. Finally, while the badge-giving style at the end of the platform adds a competitive element, the interface is unappealing, and the platform can be too long for children to keep their attention throughout. Table below shows the strength and weaknesses of R2S platform.

Table 4. Strength and weaknesses about R2S studies

	Strength	Weaknesses
Route 2 School Platform	Online Platform for Traffic safety Education	Only Pictorial representation of the situations. Need to add the video of specific traffic situations
	The Platform raise awareness among the children about traffic safety	Platform is developed on 2D level and there should be inclusion of 3D/ VR technology with the advancement.
	The Platform touches all the aspect of Traffic safety in four modules i.e. Knowledge, Risk detection, Risk awareness and Situation awareness	The Platform was developed only for certain age group (Children) and not include all the age group
	The feedback after every question made the understanding of the children about each question	No specific app that can be adapted in the mobile phones for usage. As using platform on mobile will be easier and friendlier
	The Badge giving style at the end of the platform on the basis of their performance make it more interesting and competitive for the children.	The interface is not attracted and the platform is long for the children to stay focus for the whole time while completing the platform.

4. Discussion

4.1. Critics and Suggestions

Almost all the researchers suggested adapting the platform to mobile phone. And most critics were related to images (they want them larger), questions and feedbacks (better formulation). (Putri, 2020) found that the interface needs improvement while (MAYALEH, 2021) found that the platform lacked elements on improving active mobility. (Sitohang, 2021) suggested to reduce the number of modules and to adapt the content to the real need of students as future drivers. In addition to that (Riaz et al., 2019) want the addition of control group to make the research more

effective. Lastly, Imran (2022) suggest the addition of badges at the end and educating the teacher about R2S platform to make it more effective. Below Table shows details

Table 5. Critics and Suggestions about the R2S platform in tested countries

Author	Critics and Suggestions
(MAYALEH, 2021)	Not adapted to mobile phone Feedbacks got 36.7% likes against 16.5% dislikes.
(Pham, 2019))	To adapt the platform the Mobile Phones Modules are lengthy to complete.
(Putri, 2020)	Change introduction from audio to video and text Add alternative access modality for children who do not have email. Improvement in the interface and use larger pictures
(Sitohang, 2021)	Adapting the platform to the mobile phone Reducing number of modules *Content change: adapting to future drivers than to pedestrians
(Riaz et al., 2019)	Addition of control group to investigate the detailed effect. Change the picture into video for more involvement of children
Imran (2022)	Use large picture or change into videos Add audio in the back of each question Educate the teacher first about R2S platform so that they can convey their student properly.

However, the research was initiated in Belgium, an economically developed nation, and later extended to developing countries. This diverse selection allows for a comprehensive analysis across different continents and economic contexts, providing insights into road safety concerns, particularly pertinent in developing countries due to limited infrastructure and awareness (Walugembe et al., 2020). The primary objective of this study was to identify the strengths and weaknesses of the R2S platform, examine the similarities and differences among the tested countries, and provide recommendations for its future implementation.

The R2S platform has shown promise in raising awareness among children about road safety. This is a critical aspect, given the vulnerability of young children to pedestrian accidents. The engagement of children in digital games and interactive learning, as facilitated by the R2S platform, aligns with contemporary educational trends (McGonigal, 2011b). It is clear that e-learning platforms, like the R2S, enhance learner engagement and performance in traffic safety education (Krause et al., 2015).

One notable finding is the variation in the target age groups among the tested countries. Developing countries often included a wider age range, while developed countries like Belgium focused on a narrower age group. This raises questions about the adaptability of the R2S platform to different cultural contexts and age demographics. Future adaptations should consider expanding the platform's applicability to a broader age range to reach a wider audience Analysis of five-year traffic accident data revealed discrepancies in reporting standards, particularly in underdeveloped countries, where injuries are often underreported, leading to lower accident and casualty rates. Developed countries like Belgium exhibited lower fatality rates due to advanced healthcare facilities. Moreover, feedback on the R2S platform recommended mobile adaptation, improved image quality, question formulation and tailored content.

While the R2S platform effectively raises road safety awareness among children, limitations include its reliance on pictorial representations. Suggestions for improvement include integrating video or 3D/VR technology, addressing age-group limitations, and developing a mobile application. Despite its limitations, the platform remains a valuable tool for enhancing children's road safety awareness.

5. Conclusion

The study conducted six diverse studies in different countries to assess children's awareness of road safety. The research focused on both developed and developing nations, providing valuable insights into the issue's global significance. The demographic characteristics of the participants varied, allowing for comparisons across different

populations. The study revealed underreporting of accidents and casualties in developing countries and emphasized the need for more effective measures, particularly in those regions. The comparison between developed and developing countries highlighted different approaches to address road safety concerns. The approaches i.e. the quick emergency response in developed countries ensure quick assistance to accidents victims decreasing the death rates as compared to developing countries. Also, comparison highlights the traffic education and training to the vulnerable road users at school level so that it improves their traffic awareness while on the road. Other approaches i.e. capacity building, accurate data collection and accident reporting, infrastructure investment can address the road safety concerns in developed and developing countries. The evaluation of the R2S platform demonstrated its positive impact on children's knowledge and awareness of road safety, although some improvements were suggested, such as adapting the platform to mobile phones and incorporating interactive elements. Despite its limitations, the platform effectively raises awareness about road safety among children and could benefit from enhancements like video or 3D/VR technology. Overall, the study emphasizes the importance of continued research and intervention to reduce accidents and fatalities and enhance road safety education worldwide.

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