

# Promoting road safety education in young adults with Facebook: a mini-case study in engineering university students in Ecuador

## Promoviendo educación sobre seguridad vial en jóvenes adultos con Facebook: un mini estudio de caso en estudiantes universitarios de ingeniería en Ecuador

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### Abstract

The road safety education is essential to reduce road traffic deaths. This study aims to promote road safety education in young adults with social networks. The research experiments if through Facebook posts, young adults increase their knowledge of road safety. The case of study was implemented in twenty-five university students from Ecuador, between 21 and 27 years old. The method of the research consisted to create a Facebook page where it posted two daily publications (informative and comic). All participants had to interact with their content for approximately four months (between November 2019 and February 2020). Students answered two tests to assess their knowledge of road safety and a survey about the web page. It used qualitative and quantitative approaches to analyze the collected data. As a result, Facebook significantly improved road safety knowledge (22%). The young people agreed with its use in an academic context. This methodology could apply to other fields, given its simplicity and practicality, which can quickly reach a lot of people.

**Palabras clave:** Ecuador, Facebook, road safety education, young adults.

### Resumen

La educación en seguridad vial es importante para reducir fatalidades por accidentes de tránsito. El objetivo de este estudio es promover la educación sobre seguridad vial en jóvenes adultos con redes sociales. La investigación evalúa si a través de las publicaciones de Facebook, los jóvenes adultos incrementan su conocimiento en seguridad vial. El caso de estudio se implementó en veinticinco estudiantes universitarios de Ecuador, entre 21 y 27 años. El método de investigación consistió en crear una página de Facebook donde hubo dos publicaciones diarias (informativas y cómicas). Todos los participantes tuvieron que interactuar con su contenido durante aproximadamente cuatro meses (entre noviembre de 2019 y febrero de 2020). Los estudiantes respondieron dos pruebas para evaluar sus conocimientos sobre seguridad vial y una encuesta sobre la página web. Se utilizaron enfoques cualitativos y cuantitativos para analizar los datos recopilados. Como resultado, Facebook mejoró

significativamente su conocimiento de seguridad vial (22%). Además, los jóvenes estuvieron de acuerdo con su uso en un contexto académico. Esta metodología podría aplicarse a otros campos, dada su simplicidad y practicidad, y a que pueden llegar rápidamente a muchas personas.

**Palabras claves:** Ecuador, educación en seguridad vial, Facebook, jóvenes adultos.

## 1. Introduction

Each year, approximately 1.35 million people die because of road traffic crashes worldwide, which is the principal cause of death for children and young adults aged 5-29 years [1]. Most of these accidents occur in low- and middle-income countries. In 2019 in Ecuador, 2180 people died in traffic accidents, and around 20,000 were injured [2]. In this year, 33% of light vehicles were the main ones to be involved in traffic accidents, 23% were motorcycles, 12% were trucks, 6% were buses, and 25% were unidentified vehicles. Among the various causes of accidents, the human factor is the dominant one in the human/vehicle/environment system. One way to face this is through road safety education (RSE), which across the world is the primary method to reduce traffic accidents [3].

The RSE is based on three aspects [4]. First, it promotes knowledge and understanding of traffic rules and situations. Next, it improves skills through training and experience. Third, it strengthens and/or changes attitudes toward risk awareness. The good practices in RSE [5] included active student participation, where they can improve their psycho-social skills through multifocal interventions (e.g., youth with parents, youth with teachers). Also, the quality of the implementation of the program and the consistency of messages are critical for the success of the practice. There is plenty of researches about RSE programs/practices around the world. They employed mainly interaction with real traffic experience (e.g., [6]), traffic simulators (e.g., [7]), e-learning (e.g., [8]), involving parents (e.g., [9]), among others. E-learning is one promising option regarding the advances in technology.

The e-learning could perform employing social media due to the increase in its use in recent years. In 2019 in the US, adults who use at least use one social media site were 90% (18-29 years old), 82% (30-49 years old), 69% (50-64 years old), and 40% (65 + years old) [10]. RSE was used mainly YouTube (e.g. [11]), but not other social media such as Facebook or Instagram. Facebook is one of the most popular social networks worldwide [10], [12]. It is one of the most-used social networking sites today with millions of users [13]–[16]. In a large sample study, 92% of students reported using Facebook and spending an average of over one hour and forty minutes a day on the site [15]. Additionally, 8.4% of faculty members reported using Facebook for teaching purposes, much more than Twitter but less than blogs and wikis, podcasts, and LinkedIn [17].

Facebook has been the most researched platform for teaching and learning [18], [19]. However, the relation between Facebook use and academic performance has yielded mixed results [20]. In some studies, there was no relation between Facebook use and grades [21], [22]. Also, by using Facebook for academic activities, students can get distracted by searching other websites [23] or multitasking while using the platform [24]. Nevertheless, others reported that Facebook, used as a part of a classroom, was positively linked with cognitive and affective learning outcomes, as well as a more comfortable classroom atmosphere [25]–[27]. Besides, in a comparative study

between students who used Facebook in their academic activities and others who did not, Facebook users reported studying fewer hours per week than non-users [28]. It used Facebook in several areas, such as improve English skills [29], awareness about climate change [30], engage water customers [31], healthcare information [32], among others.

In this scenario, this paper seeks to promote road safety education in young adults with social networks. This study analyzes the impact of Facebook posts (informative and comic), and the probability of young adults to increase their knowledge of road safety. It selected 25 students from Universidad Técnica Particular de Loja in Ecuador, aged between 21 and 27. After created the Facebook web page, it posted two posters every day (informative and comic) from November 2019 up to February 2020. Students had to interact with the page. At the beginning and the end of the experiment, students answer about how much they know about some road safety topics, as well as a survey at the end, about the benefits of the Facebook web page.

To develop this research, the study is structured as follows: Section 2 gives an overview of the experimental development, describing student selection, Facebook post, Facebook web page creation, data collection, and processing. Then, section 3 presents the results of test scores, survey answers, and Facebook web page interactions. The following section discusses these results by contrasting them with previous work. It highlights the principal conclusions, explaining the limitations and contributions of the study. Finally, it provides detailed students' comments in the appendix.

## 2. Material and methods

### 2.1. Students selection

Twenty-five students, who enrolled in a road design course, participated in the experiment. This course belongs to Civil Engineering major in the Universidad Técnica Particular de Loja (Ecuador). The average age was 23 years old (min=21, max=27, SD=1.7). The distribution of these younger adults was 16% women, while 84% were men. Regularly, most of them took public transport (56%), private light vehicles (32%), while just a few uses motorcycles (8%) and some rides bicycle (4%).

### 2.2. Facebook posts

Before any Facebook post, it researched the characteristics of the posters (informative and comic) that had the least acceptance (fewer likes and shares) and greater acceptance (more likes and shares) by the people on several web pages on Facebook. As a result, both should have a proper distribution of their elements (image and text), and adequately colors and text format. Every poster had one idea to communicate. The image may be related to the text, and this one may be clear and written in a simple language. Additionally, the comic poster should be easy to understand, including real/booming situations funnily related to the traffic.

Also, posters included the most probable causes of traffic accidents in Ecuador in 2018 [32] (See table 1). It created the posters for all the days of the experiment that lasted 92 days based on the detected best features and the principal accident causes. It experimented from 11th November 2019 to 13th February 2020. It created 184 (92 informative posters and 92 comic posters), posted

every day, and distributed according to table 1. Also, this distribution was based on the principal causes of table 1, for instance, distracted driving had a higher percentage, and so two days were assigned: Monday and Sunday. Posters dimensioned 958 x 960 pixels. Around, 15h00 it posted the informative poster, while nearby 21h00 was the comic poster.

**Table 1.** Probable causes of traffic accidents in Ecuador (2018) and the poster time distribution during the week

Probable cause	%	Day
Distracted driving	24.1	Mo-Su
Speeding	15.9	Tu
Do not respect traffic signs	10.9	We
Do not respect lateral safety distance	9.2	Th
Do not respect longitudinal safety distance	8.4	Fr
Alcohol and other drugs and driving	7.3	Sa

### 2.3. Facebook web page creation

A Facebook web page called EduVial.UTPL was created and managed by advanced students from Civil Engineering [33]. The link of the web page was sharing through the Virtual Learning Environment (VLE) of the university. Students had to follow the web page and interact with its content. It was mandatory to choose their opinion about the post (likes, love, haha, wow, sad, angry), but other interaction such as share or comment it was optional. Not all students met the first part. Students that participate in the experiment received one extra point in the course of road design. All posters were made by advanced students. However, they were review and modify/ approval by the instructor. After this authorization, advanced students could post them on the web page.

### 2.4. Data collection

It performed two tests to answer the objective. One test (pre-test) was taken at the beginning of the experiment to know how much students know about road safety. Questions were multiple-choice with four options each. The test had seven questions (see table 2) related to the principal causes of traffic accidents in Ecuador. It carried out the test in the VLE (Virtual Learning Environment), where the answers appeared randomly. It graded every question as 10/7 points, so the maximum grade was 10 points. Additional to these questions, it asked how do they rate their behavior as a road user (1 = careless, 10 = excellent). Also, in the end, it took the test with the same questions (post-test) to see their learning after the experiment.

Additionally, at the end of the experiment, it asked two questions in a survey: 1) do you think that the use of the Facebook page improved your knowledge of road safety? (Y/N question), and 2) why do you think the Facebook page helped you (or did not) to improve your knowledge in road safety? It performed those questions to understand their opinion about the web page and its content.

## 2.5. Data processing

After the grades both tests, it analyzed their average score, the personal scores, and their differences. First, it calculated the average score, then, the difference between the post-test score and the pre-test score. Also, it estimated the score difference in every question between the post-test and the pre-test. Furthermore, it analyzed every survey's answer and clustered in several categories. As additional information, the statistics (processed data), coming from the Facebook web page, was used in the analysis.

## 3. Results

### 3.1. Tests scores

In the pre-test, students got an average score of 5.1 points (min=1.4, max=8.6, SD=1.8), while in the post-test they got 6.3 points (min=2.9, max=8.6, SD=1.7) (see table 2). They improved by 22% more. In order to find a statistically significant difference between those values, it performed a t-student test using the statistical software Minitab 14.2 [34]. It employed a 95% level of confidence as a parameter of this analysis. Scores from the pre-test differ significantly from post-test (p-value = 0.004), which means that the experiment improves their knowledge in road safety.

**Table 2.** Tests scores, its difference, and answers to the questions

# student	Pre-test score	Post-test score	Score difference	Questions						
				1	2	3	4	5	6	7
1	5.7	8.6	2.9							
2	5.7	4.3	-1.4							
3	5.7	4.3	-1.4							
4	4.3	7.1	2.9							
5	2.9	5.7	2.9							
6	7.1	4.3	-2.9							
7	4.3	8.6	4.3							
8	2.9	5.7	2.9							
9	2.9	4.3	1.4							
10	5.7	7.1	1.4							
11	7.1	2.9	-4.3							
12	1.4	8.6	7.1							
13	5.7	7.1	1.4							
14	5.7	5.7	0							
15	7.1	7.1	0							
16	8.6	7.1	-1.4							
17	5.7	8.6	2.9							
18	7.1	4.3	-2.9							
19	4.3	7.1	2.9							

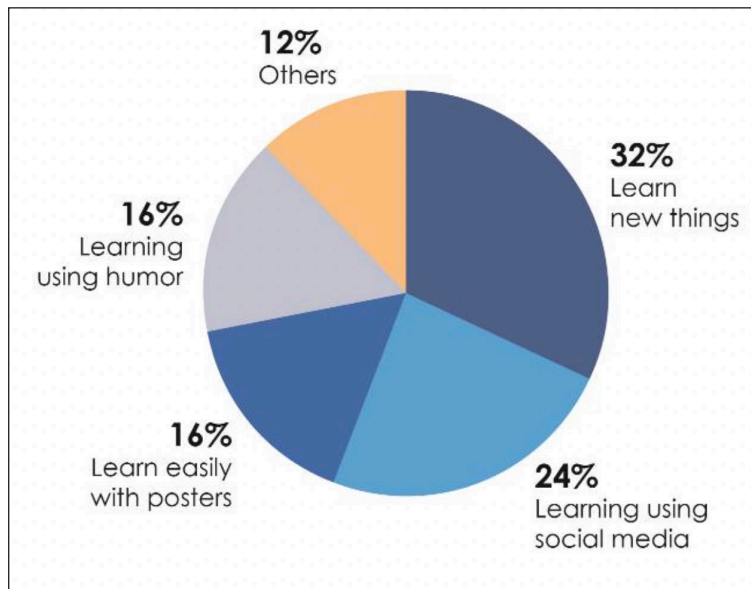
# student	Pre-test score	Post-test score	Score difference	Questions						
				1	2	3	4	5	6	7
20	5.7	7.1	1.4							
21	2.9	7.1	4.3							
22	4.3	4.3	0							
23	2.9	5.7	2.9							
24	5.7	7.1	1.4							
25	7.1	7.1	0							
<b>Improving the pre-test score</b>			<b>Equal score in pre-test and post-test</b>		<b>Did not improve the pre-test score</b>					

1. How many people approximately do you think lost their lives last year in traffic accidents in Ecuador?
2. What do you think is the principal cause of traffic accidents in Ecuador?
3. What is the speed limit for heavy vehicles on urban roads?
4. What is the minimum safety side distance that one vehicle must keep from another?
5. How could it calculate the safety longitudinal distance that one vehicle must keep from another?
6. If someone is distracted for 1 second at a speed of 100 km/h, how much does the vehicle travel?
7. How much alcohol in the blood is a driver fined?

Table 2 also shows the differences between the post-test minus pre-test scores and the questions where students got more, less or equal score. Students got more improvement in question 4 and more errors in question 7. The first one was related to the minimum safety side distance and the other to driving and drinking. Most students had an improvement in their knowledge (60%), for instance, one student that got 1.4 points in the pre-test, reached up to around 7 points more. On the other hand, 16% of the students got the same points, while 24% got less score in the post-test than the pre-test. Maybe these students answered the pre-test randomly since there is not any reasonable explanation that they got fewer grades in the post-test, being that they already knew the answers in the pre-test.

### 3.2. Survey answers

In the survey, a hundred percent of the students answered that the posts on the Facebook web page helped them to improve their knowledge in road safety. Their detailed answers are shown in the appendix, while their statistics are in figure 1. In this figure, some students (32%) answered that the web page helps them to discover new things about the topic, while others (24%) highlights the use of social media to learn. Few students thought that they learned because of the use of simple images (16%) or humor (16%). But almost all of them express that they learn on the Facebook web page, confirming the previous positive results. In figure 2, it made a word cloud with the students' answers that are available in the appendix. In this figure the most repeated words were helped, social networks, traffic, distance, know, page, among others. Also, it were mentioned funny, comic, learn, taught, memes, education, posts, Facebook, etc. All of these words show the impact that a Facebook page could have to teach road safety, and the students realized that.



**Figure 1.** Results of the question: why do you think the Facebook page helped you (or did not) to improve your knowledge in road safety?



**Figure 2.** Results of the question: why do you think the Facebook page helped you (or did not) to improve your knowledge in road safety?

In the pre-test, the average result of their behavior as a road user was 7.9 (min=1, max=10, SD=1.4), and in the post-test, they increased that number up to 8.2 (min=1, max=10, SD=1.0). This perception may be due to the increase in road safety knowledge. The student perceives as a better road user, after having acquired some knowledge. It can be adverse when the student underestimates the real risks in the road. Either way, it is something that should study in the future.

### 3.3. Facebook web page interactions

Interestingly, the web page started with 25 followers (test subjects), but this number was increased up to around 300, as seen in figure 2. Followers are the people that subscribed to the web page. It increased this number, because, students were sharing the web page posts in their profiles, so their “friends” started to follow the page. It got this information from EduVial.UTPL statistics [35]. Figure 2 also shows the organic reach, which refers to how many people the web page reaches for free. It reached more than 1200 persons with an average reach of around 450 people during the experiment. These statistics show that posts in the social network could reach more expected people. This number could increase or reduce depending on the Facebook web page and its posts.

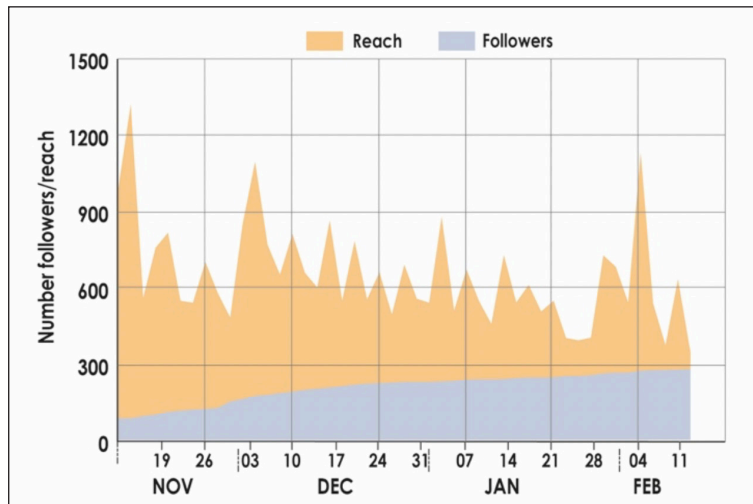


Figure 2. Number of followers/reaches of the Facebook web page during the experiment

According to the EduVial.UTPL statistics, most of the followers were men (66%), as shown in figure 3. According to this figure, most followers were between 18-34 years (test subject plus new followers). They were from Ecuador (267) and a few from Spain (5), USA (2), and Colombia (1). They connected throughout the week in very similar average numbers: Monday (261), Tuesday (266), Wednesday (268), Thursday (269), Friday (268), Saturday (268), and Sunday (266). More than 100 were connected from 04h00 up to 20h00. At 17h00 was the time where the web page had the highest number of connected followers (166). Also, they were connected mainly through mobile devices (77%), and the rest were using computers (23%).

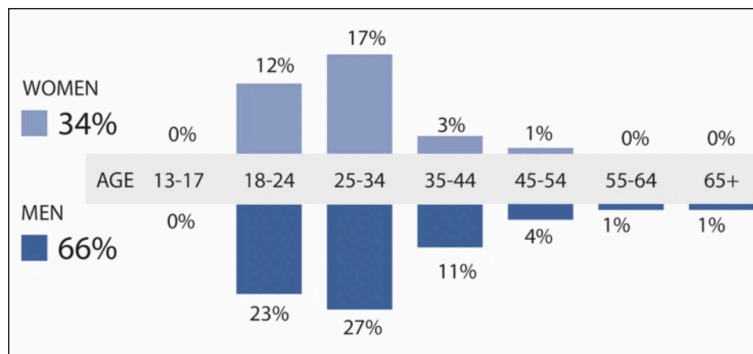


Figure 3. Follower’s descriptions of the Facebook web page



Regarding the posts, figure 4 shows four examples (good and bad) of the posters of EduVial.UTPL web page. In these examples, posters reach more people because they were shared several times; in this case, between 7 and 13, while the others with poor reach were no shared at all. If a post is shared, more people could express their opinion, share it, or comment on it. The less successful posters had information that people previously knew, it offered it in a monotonous way or not funny at all.

## 4. Discussions

This study showed that the material shared through Facebook, increased significantly the road safety knowledge of the participants. This result is similar to previous studies, for example, positive road safety messages persuaded young drivers to drive better [36].

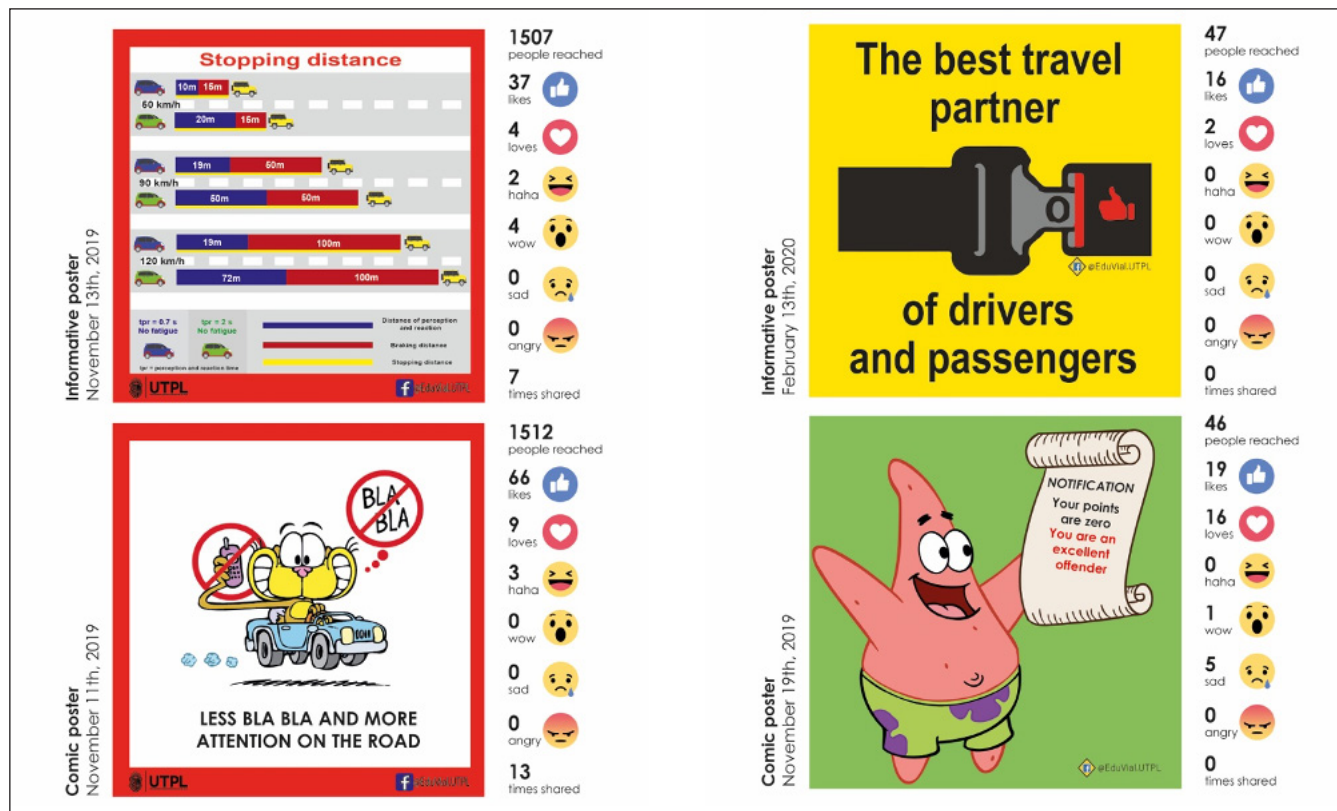


Figure 4. Good and bad examples of posted posters in the Eduvial.UTPL web page

Appropriate road safety education for the general population employing social media could increase the knowledge of traffic rules for all road users [37]. This interaction (student-social network-material) is possible since many of these students come to university with already existing accounts from their high-school years [38], and social networks allow a free-learning, interactive environment regardless of time and place [29].

When students answered about the web page, all of them agreed that it helped them to learn new things, through images and humor. This study supports the positive impact of Facebook in the academic context, despite the previous mixed results. However, it should consider some particular characteristics of this work. First, the website was managed by other students and not

by the instructor so students could freely interact with the content, without feeling observed, evaluated, or criticized, reducing the possibility of social desirability effect. If the instructor is a Facebook friend of their students, they can denounce violations of their privacy [39]. Second, this experiment was a complementary activity, so students shouldn't have felt the pressure of a regular subject. Finally, the Facebook web page posted just posters, not assignments, essays, and so on. Similar to how it shares in social media, while if posting academic stuff, the student could feel different. Using Facebook for academic purposes, care should be taken not to interfere too much with the regular activities of the students on Facebook, since Facebook users consciously or unconsciously appeal to a specific audience, their friends and family [40].

Despite these promising results, there are several conditions to discuss. First, students had to participate in the page with a bonus of 1 extra-point in the road design course. Students were able to accept or reject the offer; but, all of them decided to participate. Give something in return for participating in an investigation is typical of studies where it is difficult to get a sample or very few people want to participate in it, for example, people who try a product before going on sale. Based on this widespread practice, this extra-point should not impact considerably on their behavior while using the web page.

Second, in every post, students had to pick one option (like, love, haha, wow, sad, angry) based on what they feel about its content. When the post was fun, some participants posted that they like it or find it funny. On the other hand, when an informative post was presented, the students reacted mainly with likes. Despite this, there was no clear trend between Facebook options and the content of the post. This is because each choice is subjective, for example, a "like", it can mean that the student agrees with the information in the post, that he/she likes the content or it is something positive for society. Therefore, their choices are based on the individual's perception, not on the Facebook icon.

Third, since students want to be part of the experiment, they could only participate from November 2019 to February 2020, where the academic semester ends. Therefore, it performed in those months this experiment. In the year, there are two semesters, this one and another from April to August of each year. There are no particular reasons to think that the chosen semester can influence the results of this study.

Fourth, the sample of this research (25) was selected based on the number of students enrolled in the course of road design. These participants are young people who are more in danger inroads [1]. Although this is a low number, it is significant due to the found results. Students in civil engineering career should have more knowledge about road safety than others, given that they learned how to design streets and roads. However, in their curriculum, they only take courses to calculate things; for instance, it employed the dimensions of the vehicles to design the widening of the road. They learn the behavior of pedestrians or drivers on the road, for design purposes, but not how they should behave. Therefore, participants could consider having very similar knowledge to any other student of engineering. In consequence, it is a sample that represents this kind of student.

Finally, most of the participants were pedestrians. The website focused mainly on driving concepts; however, pedestrians should know certain driver behaviors that may have and put endanger them. Besides, these students are likely to have their vehicles, considering the trend in Latin America [41]. This knowledge is necessary before getting the driver's license. Therefore, the training received will be useful in any case, being a pedestrian or driver. It is necessary to notice that RSE should be part of a lifelong learning process [5] because it requires a profound knowledge of living in society.

## 5. Conclusions

This paper aimed to promote road safety education in young adults with social networks. This study analyzed if, through Facebook posts (informative and comic), young adults increase their knowledge of road safety. Education is one of the “four E’s”: education, enforcement, engineering, emergency systems. Around four months, 25 students were exposed daily to 184 posters related to road safety on a dedicated Facebook web page. After studying the results, it presents the following conclusions:

Based on the students’ scores, the posters shared through the Facebook web page, improved their road safety knowledge.

Additional to this significant rise in the post-test scores, the web page reached more audiences than the test subjects. It is an effect after students shared the posts through their Facebook profiles. It reached around 300 followers and more than 1200 persons. It promotes the idea that social media could broadcast academic content easily. However, it should be adequate for the age and maturity of the audience and the content may present attractively.

This study has several limitations. First, it included only 25 university students that could perform differently from others with another age or education level. Second, the scores are based on the proposed test and could differ from another evaluation tool. Third, the improvement in the knowledge was a result of the two daily posts (informative and comic posters), which could be distinct from other materials, such as videos, assignments. And last, it made all posters based on the principal probable causes of traffic accidents in Ecuador, and it should be different in other countries.

Despite these limitations, this research shows that road safety education, in terms of knowledge, is possible employing Facebook. Besides, the academic content on Facebook is well received by the students. If the posts are interesting, the web page could get more followers or can reach more people, similar to what happens with the snowball effect. Furthermore, instructors may adopt this methodology, posting posters with what they want to teach. Finally, the use of both posters (informative and comic) helped to reach a wider audience; because an informative post could attract only some people.

## Appendix

Below are the detailed answers to the question: why do you think the Facebook page helped you (or did not) to improve your knowledge in road safety?

"Some posts had information that I did not know."

"It helped me, because with its texts in a creative way, and in a little funny way, it keeps us better informed about road safety, and thus prevents traffic accidents."

"It helped me since it is a social network that we daily review and unconsciously read the road education publications, and we learn."

"It taught me the following. A small distraction of the driver could produce a traffic crash. Using the cellphone you can travel a long distance without noticing what is presented on the road. The alcohol immediately influences the driver causing catastrophic [undesired] effects."

"At present, technology is advancing a lot so we have to take advantage of it. Most people spend [time] on social networks or websites, watch news, movies, entertainment, sports. Every day I use Facebook so I always saw the posts on the road education page [EduVial.UTPL]. Some [of them] were very funny and that attracts attention to learn."

"Because the [given] information was so easy to understand."

"Somehow it helps to change the perception when driving since the [web] page and its publications were like a type of knowledge campaign for the driver and pedestrian."

"Because now I know more things [than before] such as the minimum lateral distance, safety seconds [safe distance between vehicles], alcohol levels, avoid distractions, and know the different speeds according to the area. With all this information you learn road safety."

"It helped me because through the social networks that we generally use, [it helps to] have more knowledge of the different traffic rules and laws more comfortably and concisely."

"Because there were data regarding traffic accidents that I did not know [before]. It helped me to become aware of the dangers of being distracted behind the wheel [while driving]."

"[Learn] small details such as lateral distance. The social network offered memes [comic posters] with information."

"Because it is an attractive means to learn new things. In the shared images [posters] the information was accurate and concise."

"Because at the time of reading the posts they were brief and easy to understand."

“It showed practical examples such as how it measures the distance between vehicles in seconds [two-second rule].”

“Of course, because every day they published interesting things that increase interest in road safety.”

“Because the [web] page was regularly updated, and people spend a lot of [time] browsing this social network.”

“It's a bit funny because of the memes [comic posters] that were posted on the web page. They present some important data that most inexperienced drivers do not know, such as the distance a vehicle travels when breaking if they go at an "X" speed.”

“It helped me because day by day we used social networks. It reminded us of the traffic rules, [which] unconsciously we recorded them to apply in life as drivers or pedestrians.”

“I believe today, social networks are the principal means of communication with which you can reach a common good, as is the case of the EduVial Facebook web page. Its daily publications focused on the topic of road education. I obtained a lot of information about it, of which I did not know, and now I remember it every day.”

“It helped me because, seriously or funnily, they explained about driving rules. Also, precautions and curious facts about the road issue. It helped me become more aware to improve our culture [knowledge] regarding transportation issues and driving rules.”

“Because there was a good interaction with its content [the web page content].”

“It helped us to become aware of the impacts if we do not respect the traffic laws, and the irresponsibility that is made by a driver, that is, without measuring the consequences.”

“Because it taught us the most important thing about road safety, how we should behave.”

“In particular, it helped me to know more about roads since the information provided on the page was very striking and informative. This helped me to get more knowledge.”

“Currently, the memes [comic posters] in social networks are booming and is a very intuitive way to educate people. Many people in addition to communicating through social networks look for memes [comic posters] to share them with other people. This page used these memes [comic posters] in a funny way to reach people, and they learned through them.”

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