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Evaluation of a Road Safety Education Program Based on Driving Under Influence and Traffic Risks for Higher Secondary School Students in Belgium

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Received: 22 March 2019; Accepted: 17 May 2019; Published: 27 May 2019

Abstract: Road safety education has been recognized as an instrument for reducing road accidents. This study aims to evaluate the road safety education program "Traffic Weeks" among higher secondary school students (age 16–19) in Belgium. The program focuses on driving under influence (DUI) and traffic risks. This study investigates whether the program has an effect on socio-cognitive variables using a questionnaire based on the theory of planned behavior. During the pre-test, 445 students filled in the questionnaire, while 253 students filled in the questionnaire during the post-test. Of these, 175 questionnaires could be matched. The results indicate that the students already had quite a supportive view of road safety at pre-test, with female students showing a more supportive view of road safety than male students. The DUI workshop had a positive effect on most socio-cognitive variables (attitude, subjective norm-friends, and intention) of female students in general education, while the traffic risks workshop only affected perceived behavioral control of female students. In terms of appreciation, students had a significantly higher appreciation of the DUI workshop compared to the traffic risks workshop. During the focus groups, students gave recommendations to improve the program.

Keywords: traffic safety; driving under influence; traffic risks; education; pre-drivers; evaluation

1. Introduction

1.1. The Use of Road Safety Education as an Instrument for Reducing Road Accidents

Among young people aged 15–29 years, road traffic accidents are the leading causes of unintentional injury and death. Road traffic accidents account for approximately 35–40% of the injury-related mortality among teenagers and young adults in Western countries [1,2], and are estimated to be the ninth leading cause worldwide for all age groups. Moreover, it is expected to become the seventh leading cause by 2030 [3]. The severity and frequency of road traffic accidents are influenced by factors related to the vehicle, road environment, and human error. Human error can contribute to 95.4% road traffic accidents and outweigh the environmental and vehicle factors significantly. Human error is caused by many interacting factors, which include practical inexperience with the driving task [4,5], but also norm-breaking behaviors such as speeding, distracted driving, and sensation seeking [6–8]. Other than inexperience and norm-breaking behaviors, their alertness in a traffic situation and perception about road safety contributes to them exhibiting various forms of reckless driving behavior [8]. Therefore,

the substantial focus should be on human factors and developing strategies that will reduce human error. Road safety education is one of the five E's in order to increase traffic safety: Encouragement, Enforcement, Evaluation, Engineering and Education [9]. It has been recognized as an instrument for reducing road traffic accidents [10], which is based on three main pillars [11]: (1) Increasing knowledge and understanding of traffic rules and situations, (2) improving skills through training, and (3) increasing and/or reinforcing the positive attitudes toward risk awareness, safety, and safety of other users. Road safety education should be tailored according to the age group and experience of the learners. For pre-drivers, these programs typically focus on classroom instructions with topics such as vehicle operation, road traffic laws, factors which affect driving (e.g., driving under influence and distractions like mobile phone use), and driving practice with an instructor or a combination of both [12,13].

1.2. School-Based Road Safety Education Programs and Their Evaluations

School road safety education programs have been shown to be effective in increasing knowledge and safer behavior among participants globally. Programs targeting vulnerable road users (e.g., cyclist safety programs) are successful in transferring knowledge to road users about safe cycling [14,15] or increasing compliance in helmet use among motorcyclists [16]. School road safety education programs targeting young novice drivers or pre-drivers vary in their respective content and style. School-based road safety education programs targeting a specific behavior, like driving under influence, have been effective in expanding young people's knowledge and skills for protecting them. These programs include classroom lessons and activities on the dangers of driving under the influence [17] or by visually demonstrating social, physical, and emotional consequences that drinking and driving can have both on a school and a community [18]. Road safety education programs for learner drivers focusing on reducing risk-taking given using seminars and workshops have been effective in reducing by 44% the relative risk of a crash involving participants [19].

It has also been argued that although pre-driver education programs help in making the young adults more aware about driving safely, improvements are needed to enhance driver safety and reduce the crash involvement of young drivers. It has been argued that road safety education can increase early licensure and put young adults at risk [20]. It is sometimes stated that "driver education does not work", especially for younger adults [21]. Results from one of the biggest experimental studies and driver education evaluations in the 1980s (i.e., "DeKalb") showed that education failed to show a long term benefit, even though there was evidence of improvement in knowledge and skills in the study [22]. This project resulted in a decline in school-based education programs in the United States. Researchers in the traffic safety domain have also argued that education courses for novice drivers will not reduce the risk of crashes if the only focus is on fulfilling a driving course, and researchers also point towards some pre-driver education programs having no evidence of improving safety-related attitudes or in reducing crash involvement [23–25]. Therefore, other factors must be considered when examining driver education [26]. For example, factors such as gender, personality, and socioeconomic/education status have been shown to affect the likelihood of drivers being in a crash [27–29]. However, in order to know whether educational programs have beneficial effects, they should be evaluated more.

1.3. Aims of the Study

The main aim of the study was to evaluate the school-based road safety education program 'Traffic Weeks' (see Section 2.1 for more information) targeting higher secondary school students in Belgium.

The study aimed to answer six research questions: (1) What are the pre-test values for the socio-cognitive and behavioral variables of students of the third grade of higher secondary school? (2) Is there an immediate effect of the DUI workshop on socio-cognitive variables of students of the third grade of higher secondary school? (3) Is there an immediate effect of the traffic risks workshop on socio-cognitive variables of students of the third grade of higher secondary school? (4) Is there a difference in the opinion about the DUI workshop and the traffic risks workshop? (5) Does program

appreciation differ in function of gender and/or education type? (6) How do students describe their Traffic Weeks program experiences and which suggestions are given in order to improve the program?

2. Methodology

2.1. Traffic Weeks

Traffic Weeks is a large-scale school-based road safety education program that runs in the Flemish-speaking part of Belgium. It focuses on two pillars that are mentioned in the introduction: (1) Increasing knowledge and understanding of traffic rules and situations, and (2) increasing and/or reinforcing the positive attitudes toward risk-awareness, safety, and safety of other users. The participants in this program are from the third grade of higher secondary school (i.e., 16–19-year-olds). In Belgium, a driver's license can be obtained at 18 years of age and a provisional license at 17 years of age. As a consequence, some participants in the program have already received either a provisional or a definitive license, while the majority have no driver's license. The program is therefore tailored for this target group (i.e., pre-drivers). In addition, the program is offered to students of three education types (i.e., general, technical, and occupational). General education prepares students for university. The education is focused on theory and general knowledge. Technical education, like general education, offers a theoretical education but also includes courses that are focused on practical experience. It prepares students both for university or a specific job or function. Occupational education, as a rule, prepares students for a specific job or function. This education is focused on practical experience. Although all these education types offer the possibility to go to university, students of occupational education need to follow an extra year of higher secondary school before they are allowed to go to university.

Traffic Weeks is organized by the Flemish foundation for traffic knowledge (VSV), an organization in Belgium that focuses on increasing traffic safety awareness. The registration for the program was done by schools, hence the students did not register for the program themselves. Schools that are interested in this program register through a website (https://www.verkeeropschool.be/project/verkeersweken) and give their preference in terms of time and location. The program costs 1000 euros/week and consists of workshops on important traffic themes adapted to the age of the students. The workshops are conducted by VSV teachers and take one lesson hour (i.e., fifty minutes) per workshop. Schools can decide on the composition of groups, the only criteria are that the groups should not be bigger than 20 students and that each group is composed of students of the same grade. Although the program focuses on higher secondary school students in general, this study focuses on higher secondary school students of the third grade (16–19 years old). The program for this age group focuses on driving under Influence (DUI) and traffic risks (speeding, fatigue, and distractions).

DUI is targeted as it is considered the most important contributing factor to road traffic accidents [30]. According to a European Commission study, young drivers in Belgium, Italy, Cyprus, and Finland were reported to engage in drinking and driving more than their peers in other countries in Europe. The study further showed that Belgium had the most cases of serious injury from alcohol-related accidents in Europe. According to a study conducted in 2012, 42.5% of the seriously injured in a road traffic accident in Belgium had alcohol in their blood [31]. Young, inexperienced drivers are more at risk of a road traffic accident as compared to older, experienced drivers under the influence of alcohol as alcohol consumption impairs a wide range of skills, which are necessary for driving safely [32,33]. Young drivers are inexperienced in both driving and drinking, and the potential harm is multiplied when these two activities are combined.

Traffic risks (speeding, fatigue, and distractions) are also targeted. Young drivers have a tendency to violate traffic rules, which results in more accidents than older drivers [34]. Speeding is a major concern for young drivers as high speed accidents are characterized by a greater likelihood of fatalities and higher numbers of injuries per accidents [35]. Young drivers are involved in higher speed crashes as compared to other age groups [36]. Drowsiness and fatigue affect the alertness, concentration and

reaction time and increase the risk of micro-sleeps. An accident induced by fatigue is more likely to result in death or severe injuries [37]. Educating young drivers about risk factors of fatigue can help drivers improve decision making and recognizing sleepiness [38]. Distraction for drivers is defined as a specific case of inattention and is associated with a secondary task that diverts the attention of the driver from the primary driving task [39]. Young drivers' inexperience can result in a reduced ability to judge driving demands as compared to other secondary distracting tasks [40]. Young drivers are the most vulnerable to distraction-related fatal crashes as compared to other age groups [41]. This is because they express a greater willingness to engage in distracting tasks while driving than older drivers [42]. These traffic risks, due to inexperience and intentional risk-taking, are prevalent among young drivers and result in an overrepresentation of young drivers in road traffic accidents [43].

The content of the program depends on the workshop. In the DUI workshop, students are presented with facts about alcohol and drugs, and students are given several assignments to understand the risks of DUI. In the traffic risks workshop, students are made aware of all major and minor risks (speeding, fatigue, and distraction) in a traffic situation, and the precautionary measures to avoid them are discussed.

2.2. Questionnaire

In this study, we focus both on an effect evaluation and a process evaluation. An effect evaluation measures the effect of the program in the target population by assessing the progress in the outcomes that the program set to achieve. The effect evaluation is performed either by observing behavior in a naturalistic setting [44], by checking the involvement of educated/trained participants in traffic accidents [45], or by investigating the change in the socio-cognitive and behavioral variables [46]. In this study, we investigated the change in socio-cognitive variables. A process evaluation is carried out to understand how the program actually works in practice, to help make sense of the strengths and weaknesses of the program, and to improve the program in the future [47,48]. In the current study, the socio-cognitive variables of the participants were evaluated using the theory of planned behavior (TPB) [49]. The TPB was adopted based on the recognized predictive validity of the variables in the TPB model [50–53], but also on a careful analysis of the program's targeted objectives. The TPB is one of the empirically most supported behavioral theories and has been validated in diverse research domains [54,55]. The TPB model has been used to evaluate road safety education programs to see changes in socio-cognitive variables because of the intervention [46,53,56]. Studies conducted in traffic safety have shown TPB to effectively explain intention to DUI [7,57], speeding [58,59], distractions [60,61] and other risk behaviors. The theory postulates that intention (i.e., a person's expression of support for the behaviors under study), the most proximal determinant of behavior, is determined by three conceptually independent variables: (1) Attitude (i.e., the expression of (dis)favor towards the behaviors under study), (2) subjective norm (i.e., perceived social expectations about the behaviors under study) from both friends and family, and (3) perceived behavioral control (PBC, i.e., the subjective probability that a person is capable of executing (or not) the behaviors under study). A meta-analysis of 185 studies reported that TPB accounted for 39% of the variance in intentions, with attitude being the strongest predictor of intention followed by PBC and subjective norm [62].

The online questionnaire has three sections. The first section contains demographic questions, such as age, gender, and education type. The second section is divided into two sub-sections on questions for DUI and traffic risks. For DUI, the following variables are questioned: Attitude (nine questions, e.g., "As long as you do not overdo it with alcohol, you can still drive the car"), subjective norm related to friends and family (two questions, i.e., "My parents would disapprove if I ride with a driver who has drunk alcohol" and "Many of my friends would ride with this person".), PBC (four questions, e.g., "I decide whether or not I ride with a driver who has drunk alcohol"), intention (one question, i.e., "Next time I intend to get in the car with a driver who has drunk alcohol"), and behavior (one question, i.e., "How often have you, in the past year, encountered someone who probably drank too much and was behind the wheel with you in the vehicle?"). For traffic risks, the following variables

are questioned: Attitude (five questions, e.g., "Always respecting the traffic rules is boring"), subjective norm related to friends and family (two questions, i.e., "Most of my friends adhere to the traffic rules and do not take unnecessary risks" and "My parents do not find it okay that I have violated the traffic rules or take unnecessary risks".), PBC (four questions, e.g., "I can easily estimate what other road users will do and adjust my behavior accordingly"), intention (one question, i.e., "In my next driving situation, there is a good chance that I will take risks in traffic"), and behavior (one question, i.e., "How often in the past year have you avoided unnecessary risks in the traffic and respected the rules?"). These questions used a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree). In the third section, 10 questions were added to investigate the extent to which participants were inclined to respond in a socially desirable manner, since this is a frequently mentioned potential response bias in the methodological literature on questionnaire surveys [63–68]. These questions were derived from the Driver Social Desirability Scale [65]. The social desirability questions used a 7-point Likert scale like the previous section ranging from 1 (totally disagree) to 7 (totally agree). The post-test questionnaire was equal to the pre-test questionnaire. However, this time, behavior was not questioned, since the time between the questionnaires was too short to change behavior. Instead, two questions related to process evaluation were included: One question with a 5-point Likert scale about the opinion of each workshop (i.e., "What did you think of the DUI workshop?") and a multiple-choice question with seven answer options about program appreciation were included (i.e., "The program was fun, unique, informative, useful, recognizable, clear, or none of these"). The questionnaire data were collected in January–March 2018. The link to the pre-test questionnaire was distributed by schools one week before the workshops, while the link for the post-test questionnaire was distributed one week after the workshops. 1385 students received the questionnaire. Both questionnaires took 10 min to fill in, and students who filled in both questionnaires received a movie ticket.

2.3. Focus Groups

Students voluntarily participated in three focus group discussions in September–October 2018. There were nine to 11 students per focus group discussion to describe their experiences with the workshops. Two focus groups discussed the strengths, perceptions, opinions, and experiences of the students and any needed resources for the future DUI workshops, and one focus group discussed the traffic risks workshop. Each focus group discussion took 45 min.

2.4. Design and Procedure

The current evaluation utilized a single-group pre-test post-test design. It was not possible to use an entirely controlled experimental design with pre- and post-tests in both an experimental group and a control group. On the one hand, this was due to the restricted time available for measurements, on the other hand, this was due to the many requests schools receive to take part in studies. Especially, groups that did not take part in Traffic Weeks indicated that they did not have time to participate in the study. Therefore, we adopted a single-group pre-test post-test design among an experimental group.

2.5. Analyses

The data were processed using SPSS (IBM Statistics 20). First, we recoded items dedicated to socio-cognitive and behavioral variables so that higher scores always implied a more road safety supportive view. Then, we conducted reliability analyses to determine if the separate items could be averaged for the different variables. Test-retest reliability for the different variables was verified by checking statistical significance of the correlation between variables' Cronbach's alpha at the first and second measurement. To answer the first research question "What are the pre-test values for the socio-cognitive and behavioral variables of students of the third grade of higher secondary school?", we performed a multivariate analysis of covariance (MANCOVA), with gender and education type as between-subjects (BS) variables, and social desirability as a covariate for the pre-test measurement (n = 445). For the second and third research question "Is there an immediate effect of the DUI/traffic

risks workshop on socio-cognitive variables?", we performed a MANCOVA with data of the first and second measurement. In the MANCOVA, the socio-cognitive variables served as dependent variables, with measurement (i.e., pre-test, post-test), gender and education type as BS variables and social desirability as a covariate. For the fourth research question "Is there a difference in the opinion about the DUI workshop and the traffic risks workshop?", a paired samples *t*-test was carried out. For the fifth research question "Does program appreciation differ in function of gender and/or education type?", we conducted univariate ANCOVA with gender and education type as BS variables, social desirability as a covariate, and appreciation of the program as the dependent variable.

If there was any significant three-way or two-way interaction among variables in these analyses, the interaction effect was further investigated. A Bonferroni correction served to control for type 1 errors due to multiple testing (i.e., chance capitalization). The Greenhouse–Geisser epsilon correction factor was applied to compensate for possible effects of non-sphericity in the measurements compared. Only the corrected *F* and probability values are reported. Alpha level of 0.05 was maintained for all statistical tests. For research question 2 and 3, we reported effect sizes with Cohen's delta. A Cohen's delta of 0.2 indicates a small effect size, 0.5 indicates a medium effect size, and 0.8 indicates a large effect size.

3. Results

3.1. Demographic Analysis

The participants in this study are from six higher secondary schools in Flanders, Belgium. The questionnaire during pre-test has been filled in by 445 students, while 253 students filled the questionnaire at post-test. Of these, 175 could be matched with the pre-test. Table 1 displays the distribution of gender and education types for the 445 participants at pre-test and the matched 175 participants at post-test.

Table 1. Demographic variables.

Demographic Variable	Pre-Test (n = 445)	Matched Pre-Test Post-Test (n = 175)
Gender	**Number (%)**	**Number (%)**
Male	201 (45.20)	72 (41.20)
Female	244 (54.80)	103 (58.80)
Education type	**Number (%)**	**Number (%)**
General Education	169 (38.0)	106 (60.50)
Technical Education	83 (18.70)	25 (14.20)
Occupational Education	193(54.80)	44 (25.10)
Gender x Education type	**Number (%)**	**Number (%)**
Male—General Education	57 (12.80)	32 (18.30)
Female—General Education	112 (25.20)	74 (42.30)
Male—Technical Education	41 (9.20)	13 (7.40)
Female—Technical Education	42 (9.40)	12 (6.90)
Male—Occupational Education	103 (23.10)	27 (15.40)
Female—Occupational Education	90 (20.20)	17 (9.70)

3.2. Reliability Analyses

Table 2 illustrates the results of the reliability analyses. The two items of subjective norm of both DUI and traffic risks had low internal reliability, so we used them separately in our analyses as

subjective norm-friends and subjective norm-family. The four PBC items in traffic risks also need to be analyzed separately because of low internal reliability.

Table 2. Reliability and mean scores for socio-cognitive and behavioral variables drawn from the theory of planned behavior (TPB) at pre-test and post-test.

Variables DUI	Cronbach's Alpha Pre-Test (n = 175)	Cronbach's Alpha Post-Test (n = 175)	Test-Retest Reliability	Mean (SD) Pre-Test (n = 175)	Mean (SD) Post-Test (n = 175)
Attitude	0.62	0.70	0.43	6.24 (0.55)	6.27 (0.69)
Subjective Norm-Friends	n.a.	n.a.	n.a.	4.46 (1.54)	4.70 (1.49)
Subjective Norm-Family	n.a.	n.a.	n.a.	6.57 (0.85)	6.54 (1.00)
PBC	0.66	0.74	0.52	5.81 (0.97)	5.89 (0.95)
Intention	n.a.	n.a.	n.a.	5.71 (1.34)	6.06 (1.13)
Behavior	n.a.	n.a.	n.a.	6.68 (0.78)	n.a.
Variables Traffic Risks	**Cronbach's Alpha Pre-Test (n = 175)**	**Cronbach's Alpha Post-Test (n = 175)**	**Test-Retest Reliability**	**Mean (SD) Pre-Test (n = 175)**	**Mean (SD) Post-Test (n = 175)**
Attitude	0.58	0.63	0.67	5.25 (0.97)	5.12 (1.01)
Subjective Norm-Friends	n.a.	n.a.	n.a.	5.30 (1.24)	4.96 (1.38)
Subjective Norm-Family	n.a.	n.a.	n.a.	5.74 (1.80)	5.59 (1.87)
PBC 1	n.a.	n.a.	n.a.	5.70 (1.21)	5.66 (1.26)
PBC 2	n.a.	n.a.	n.a.	5.68 (1.54)	5.40 (1.79)
PBC 3	n.a.	n.a.	n.a.	4.72 (1.37)	4.80 (1.36)
PBC 4	n.a.	n.a.	n.a.	3.99 (1.65)	4.30 (1.59)
Intention	n.a.	n.a.	n.a.	5.33 (1.61)	5.16 (1.65)
Behavior	n.a.	n.a.	n.a.	5.07 (1.71)	n.a.
Social Desirability	0.77	0.75	0.80	4.78 (0.89)	4.72 (0.84)

n.a. = not applicable.

3.3. Research Question 1: What Are the Pre-Test Values for the Socio-Cognitive and Behavioral Variables of Students of the Third Grade of Higher Secondary School?

At pre-test, students were already quite road safety supportive, as shown in Table 2. In addition, the results showed that there was a high tendency to respond in a socially desirable manner as the mean score for social desirability was 4.78.

Table 3 illustrates the pre-test values of students separately for gender and education type for the DUI workshop. There were significant differences among education types for all socio-cognitive and behavioral variables, except for subjective norm-friends ($p < 0.05$). With regard to attitude, PBC, subjective norm-family, and behavior, students of general and technical education are significantly more road safety supportive than students of occupational education ($p < 0.001$).

Table 4 illustrates the pre-test values of students separately for gender and education type for the traffic risks workshop program. There was a significant difference among gender for attitude: Female students at pre-test have a significantly more road safety supportive attitude than male students ($p < 0.001$). In addition, there were significant differences among education types for subjective norm-friends, intention, and behavior ($p < 0.05$). Occupational education students are significantly less road safety supportive regarding subjective norm-friends and behavior than general education students, while, regarding intention, technical education students showed significantly less road supportive scores than both general and occupational education students, ($p < 0.001$).

Table 3. Mean scores for socio-cognitive and behavioral variables drawn from the TPB separately per gender and education type at pre-test for DUI items.

Socio-Cognitive and Behavioral Variables Per Gender and Education Type	Mean (SD) Pre-Test (n = 445)	Mean (SD) Pre-Test (n = 175)
Gender—Male		
Attitude	6.11 (0.05)	6.19 (0.06)
Subjective Norm-Friends	4.35 (0.11)	4.10 (0.19)
Subjective Norm-Family	6.46 (0.07)	6.53 (0.11)
PBC	5.70 (0.07)	5.94 (0.12)
Intention	5.61 (0.11)	5.67 (0.17)
Behavior	6.49 (0.08)	6.54 (0.10)
Gender—Female		
Attitude	6.23 (0.04)	6.35 (0.07)
Subjective Norm-Friends	4.35 (0.11)	4.46 (0.20)
Subjective Norm-Family	6.58 (0.07)	6.64 (0.11)
PBC	5.81 (0.06)	5.89 (0.12)
Intention	5.65 (0.10)	5.78 (0.18)
Behavior	6.58 (0.07)	6.77 (0.10)
Education—General		
Attitude	6.20 (0.05)	6.26 (0.06)
Subjective Norm-Friends	4.51 (0.12)	4.56 (0.16)
Subjective Norm-Family	6.62 (0.08)	6.55 (0.09)
PBC	5.62 (0.08)	5.67 (0.10)
Intention	5.72 (0.12)	5.74 (0.14)
Behavior	6.72 (0.08)	6.76 (0.08)
Education—Technical		
Attitude	6.39 (0.07)	6.49 (0.10)
Subjective Norm-Friends	4.10 (0.16)	3.61 (0.30)
Subjective Norm-Family	6.73 (0.11)	6.72 (0.17)
PBC	6.05 (0.10)	6.22 (0.19)
Intention	5.82 (0.16)	5.95 (0.27)
Behavior	6.60 (0.11)	6.61 (0.16)
Education—Occupational		
Attitude	5.92 (0.04)	6.07 (0.08)
Subjective Norm-Friends	4.43 (0.11)	4.67 (0.24)
Subjective Norm-Family	6.22 (0.07)	6.48 (0.14)
PBC	5.58 (0.07)	5.86 (0.15)
Intention	5.37 (0.10)	5.48 (0.22)
Behavior	6.29 (0.07)	6.60 (0.12)

Note: Social desirability was entered as a covariate.

Table 4. Mean scores for socio-cognitive and behavioral variables drawn from the TPB separately per gender and education type at pre-test for traffic risks items.

Socio-Cognitive and Behavioral Variables Per Gender and Education Type	Mean (SD) Pre-Test (n = 445)	Mean (SD) Pre-Test (n = 175)
Gender—Male		
Attitude	5.03 (0.06)	5.03 (0.11)
Subjective Norm-Friends	5.14 (0.10)	5.07 (0.15)
Subjective Norm-Family	5.65 (0.14)	5.97 (0.22)
PBC 1	5.70 (0.08)	5.65 (0.14)
PBC 2	5.44 (0.12)	5.50 (0.19)
PBC 3	5.11 (0.10)	5.02 (0.16)
PBC 4	3.96 (0.13)	3.87 (0.20)
Intention	5.13 (0.12)	5.09 (0.19)
Behavior	4.77 (0.13)	5.10 (0.20)
Gender—Female		
Attitude	5.43 (0.06)	5.37 (0.11)
Subjective Norm-Friends	5.23 (0.09)	5.37 (0.16)
Subjective Norm-Family	5.40 (0.12)	5.34 (0.23)
PBC 1	5.86 (0.07)	5.77 (0.15)
PBC 2	5.23 (0.11)	5.61 (0.19)
PBC 3	4.44 (0.09)	4.66 (0.17)
PBC 4	3.93 (0.12)	3.66 (0.21)
Intention	5.35 (0.11)	5.25 (0.20)
Behavior	4.96 (0.12)	4.91 (0.21)
Education—General		
Attitude	5.20 (0.07)	5.23 (0.09)
Subjective Norm-Friends	5.39 (0.11)	5.40 (0.13)
Subjective Norm-Family	5.66 (0.15)	5.79 (0.19)
PBC 1	5.77(0.08)	5.69 (0.12)
PBC 2	5.65 (0.13)	5.81 (0.16)
PBC 3	4.69 (0.10)	4.71 (0.14)
PBC 4	4.35 (0.14)	4.30 (0.17)
Intention	5.51 (0.13)	5.57 (0.16)
Behavior	5.15 (0.14)	5.28 (0.17)
Education—Technical		
Attitude	5.38 (0.10)	5.20 (0.17)
Subjective Norm-Friends	5.28 (0.14)	5.20 (0.24)
Subjective Norm-Family	5.46 (0.20)	5.72 (0.35)
PBC 1	5.78 (0.12)	5.71 (0.23)
PBC 2	5.11 (0.18)	5.08 (0.29)
PBC 3	4.98 (0.14)	4.98 (0.26)
PBC 4	3.58 (0.19)	2.96 (0.32)
Intention	5.55 (0.17)	5.55 (0.30)
Behavior	4.87 (0.19)	5.27 (0.31)

Table 4. *Cont.*

Socio-Cognitive and Behavioral Variables Per Gender and Education Type	Mean (SD) Pre-Test (n = 445)	Mean (SD) Pre-Test (n = 175)
Education—Occupational		
Attitude	5.12 (0.06)	5.16 (0.13)
Subjective Norm-Friends	4.90 (0.09)	5.06 (0.19)
Subjective Norm-Family	5.47 (0.13)	5.45 (0.28)
PBC 1	5.78 (0.07)	5.74 (0.18)
PBC 2	5.25 (0.12)	5.79 (0.23)
PBC 3	4.65 (0.09)	4.84 (0.21)
PBC 4	3.90 (0.12)	4.02 (0.25)
Intention	4.66 (0.11)	4.39 (0.24)
Behavior	4.58 (0.13)	4.47 (0.25)

Note: Social desirability was entered as a covariate.

3.4. Research Question 2: Is There an Immediate Effect of the Program on Socio-Cognitive and Behavioral Variables of DUI Items?

There was a significant three-way interaction between measurement, gender and education type $F(10,328) = 2.88$, $p = 0.002$. Further analyses indicated that there was a significant two-way interaction between measurement and education type among male and female students, $F(10,128) = 1.96$, $p = 0.043$ and $F(10,190) = 2.80$, $p = 0.003$, respectively. Upon further investigation, there was no significant main effect of measurement for male students of all education types. However, there was a significant main effect of measurement for female students of general education, $F(5,68) = 4.66$, $p = 0.001$. The female students of general education had a significant positive impact on attitude, subjective norm-friends and intention, $F(1,72) = 15.29$, $p < 0.001$, $F(1,72) = 13.16$, $p = 0.001$ and $F(1,72) = 9.25$, $p = 0.003$, respectively. Table 5 shows the mean values at pre-test and post-test, the p-values, and the Cohen's d for the socio-cognitive variables for female students of general education.

Table 5. Effect of DUI workshop on female students of general education.

Socio-Cognitive Variables	Pre-Test (n = 175) Mean (SE)	Post-Test (n = 175) Mean (SE)	p-Value	Cohen's d
Attitude	6.25 (0.05)	6.44 (0.05)	0.001 **	0.410
Subjective Norm—Friends	4.61 (0.14)	5.08 (0.14)	0.001 **	0.380
Subjective Norm—Family	6.58 (0.09)	6.68 (0.08)	0.097	0.140
PBC	5.67 (0.10)	5.84 (0.10)	0.086	0.187
Intention	5.77 (0.13)	6.19 (0.09)	0.003 **	0.445

Note: Social desirability was entered as a covariate, ** = $p < 0.01$.

3.5. Research Question 3: Is There an Immediate Effect of the Program on Socio-Cognitive and Behavioral Variables of Traffic Risks Items?

There was a significant two-way interaction between measurement and gender, $F(8,161) = 2.01$, $p = 0.048$. Upon further investigation, there was no significant main effect of measurement for male students. However, there was a significant main effect of measurement for female students, $F(8,92) = 2.11$, $p = 0.043$. The female students had a significant positive impact on the PBC 4 ("To what extent do you have an influence on whether you get involved in a road traffic accident?"), $F(1,99) = 12.17$, $p = 0.001$. Table 6 shows the mean values at pre-test and post-test, the p-values and the Cohen's d for the socio-cognitive variables for female students.

Table 6. Effect of traffic risks workshop on female students.

Socio-Cognitive Variables	Pre-Test (n = 175) Mean (SE)	Post-Test (n = 175) Mean (SE)	p-Value	Cohen's d
Attitude	5.35 (0.09)	5.28 (0.10)	0.433	n.a.
Subjective Norm-Friends	5.40 (0.15)	5.06 (0.15)	0.074	n.a.
Subjective Norm-Family	5.31 (0.23)	5.48 (0.22)	0.583	n.a.
PBC 1	5.72 (0.13)	5.64 (0.14)	0.656	n.a.
PBC 2	5.59 (0.18)	5.44 (0.20)	0.482	n.a.
PBC 3	4.58 (0.15)	4.37 (0.15)	0.287	n.a.
PBC 4	3.64 (0.19)	4.48 (0.17)	0.001 **	0.441
Intention	5.26 (0.18)	4.89 (0.19)	0.089	n.a.

Note: Social desirability was entered as a covariate, ** = $p < 0.01$, n.a. = not applicable.

3.6. Research Question 4: Is There a Difference in the Opinion about the DUI Workshop and the Traffic Risks Workshop?

There was a significant difference in the opinion for the DUI workshop and the traffic risks workshop, $t(174) = 2.31$, $p = 0.02$. The students had a significantly better opinion about the DUI workshop ($M = 3.97$, SD = 0.83) as compared to traffic risks workshop ($M = 3.81$, SD = 0.88).

3.7. Research Question 5: Does Program Appreciation Differ in Function of Gender and/or Education Type?

As shown in Table 7, more than half the students found the program fun, useful and clear.

There was a two-way interaction between gender and education type in terms of program appreciation, $F(2,168) = 3.25$, $p = 0.04$. Further analyses showed that female students differ significantly in terms of education type, $F(2,99) = 7.49$, $p = 0.01$. The female students of occupational education had a significantly lower appreciation than general education ($p = 0.001$) and technical education ($p = 0.01$).

Table 7. Program appreciation.

Appreciation Answer Options	Percentage of Students Who Selected This Item
The program is unique, original.	26.90
The program is fun to do.	51.40
The program tells me something new, gives new information.	40.60
What is told is useful.	66.30
What is told is clear.	70.30
The examples that are given are recognizable.	50.00
None of these	4.00

3.8. Research Question 6: How Do Students Describe Their Traffic Weeks Program Experiences and Which Suggestions Are Given in Order to Improve the Program?

The first focus group on the DUI workshop described the workshop as interesting, as the workshop focuses on situations where students can be confronted with in real life. The students appreciated that the program made them aware about alcohol consumption and its effects (e.g., relation between a certain number of glasses of a certain type of alcohol and the alcohol level) and that the teacher did not forbid the act of driving under influence but made the students aware of the possible consequences. The focus group suggested to make the workshop more active (e.g., virtual reality) and also to focus more on driving under influence of drugs in addition to alcohol.

The second group also described the DUI workshop as very interesting and effective in conveying the negative effects of DUI. The students appreciated the method of using eyeglasses that give the impression of being under influence of alcohol. The focus group suggested offering this workshop to the second grade in addition to the third grade of higher secondary school to sensitize students at a younger age. Although the age you can legally drink alcohol in Belgium is 16 years, students noted that they often come in contact with alcohol at an earlier age and suggested, in that case, the program should also include aspects of riding a bike under the influence of alcohol instead of only riding a car under the influence of alcohol. The students also suggested to include elements that are used in real life to measure DUI (e.g., alcohol test).

The focus group on the traffic risks workshop noted that the workshop explained effectively the severe consequences of risks like distraction (e.g., smartphones), speeding, and DUI. The students suggested that the workshop can be more active, like looking at their smartphone while cycling and afterwards mentioning what they have seen. The aspects of other distractions (e.g., radio, air conditioning, passengers) or instruments that give you the impression that you are under the influence (e.g., glasses) should also be included in this workshop (note: Glasses that give you the impression that you are under influence of alcohol were only used in the workshop DUI).

4. Discussion

This study evaluated the road safety program 'Traffic Weeks' on DUI and traffic risks. Although changes in questionnaire responses are far from a finished product in terms of reducing actual crash risk, it is a start. Therefore, the program was evaluated using questionnaires that included socio-cognitive variables from the TPB, which postulates a link between attitudes, intentions, and behavior and has been shown to explain intention to perform risky behaviors by young road users [69–71]. It is vital to address attitudes of higher secondary school students towards driving violations and to reduce engagement in future risky driving behaviors. Road safety education programs that focus on adolescents before they become car drivers can help in preventing them from carrying out risky behaviors. Road safety education programs can therefore be used to create desirable attitudes towards driving among pre-drivers before their attitudes become established. This program used an active classroom education which promotes engagement within classrooms, working in groups, and discussions. This learning approach has been proven to be more effective than traditional methods as the students find it useful, engaging, and fun, and it has been shown to enhance cognitive ability of students [72,73].

Results indicated that at pre-test, students already had a high road safety supportive score in all socio-cognitive and behavioral variables. However, there were some differences in education type and gender. Related to DUI, occupational education students reported a lower road safety supportive view as compared to students of general and technical education on most socio-cognitive and behavioral variables (i.e., attitude, PBC, subjective norm-family, and behavior). Related to traffic risks, occupational students reported a lower road safety supportive view as compared to students of general education on subjective norm-friends and behavior, while students of technical education reported a lower road safety supportive view as compared to students of general and occupational education on intention. In addition, female students reported a higher road safety supportive view as compared to male students on attitude. This finding is in line with previous studies that demonstrated that females often report being less involved in risk-taking actions on the roads [74,75]. Results also indicated that students had a tendency to respond in a socially desirable manner, so we controlled for this in all the analyses conducted.

Immediately after attendance, the program had significant and positive effects on some socio-cognitive variables within female students. After the DUI workshop, female students of general education showed a significant positive change on several socio-cognitive variables (i.e., attitude, subjective norm-friends, and intention). These effects were small-to-medium. If we compare these results to an evaluation of a recent DUI education study [24], we can see that there are some effects of "Traffic Weeks" at post-test for female students of general education and no decrease in

socio-cognitive variables. Female students of general education had the highest appreciation of the workshops, which probably resulted in them benefitting the most from the program. These significant results could also be attributed to the sample size of female students of general education, since 42.3% students of the matched pre-test post-test sample are from this subgroup. The biggest dropout was seen in occupational education students as only 25.10% (44 of 175) were included in the matched pre-test post-test sample, which may have impacted the effect of the program on this subgroup. Dropout in post-questionnaires is often seen in all disciplines of research, and it has been empirically shown that there is an association between dropout rate and the need to receive reminders in online questionnaire studies, and there is also a factor of infrequent internet users who are more selective in their activities online [76]. The lower rate at post-test for occupational education students can be due to the possibility that the schools did not distribute the questionnaires and/or because the schools did not send reminders to fill in the questionnaire. This dropout could also be due to the finding that they reported to have a significantly lower road safety supportive view as compared to general and technical education students at pre-test, and a lower appreciation of the program.

After the traffic risks workshop, female students showed a significant effect on PBC. A possible explanation of more effects for the DUI workshop than the traffic risks workshop is that participants had a better appreciation of the DUI workshop. In addition, the fewer effects in the traffic risks workshop could be due to the broader scope in this workshop (speeding, fatigue, and distraction) compared to the scope of the DUI workshop (only alcohol and drugs).

Additional analyses were carried out to see if there are any differences in socio-cognitive variables at pre-test between students who did not fill in the second measurement ($n = 270$) and students who did fill in both measurements ($n = 175$). Students who filled in both measurements had higher mean scores in most socio-cognitive and behavioral variables related to DUI (i.e., attitude ($p = 0.001$), subjective norm-family ($p = 0.006$), intention ($p = 0.021$), and behavior ($p < 0.001$)) than the ones who only filled in the first measurement. Likewise, students who filled in both measurements had higher mean scores in subjective norm-friends ($p = 0.007$) and behavior ($p = 0.003$) related to traffic risks than the ones who only filled in the first measurement.

The focus group discussions helped in becoming aware of the experiences of students with the Traffic Weeks program and which suggestions they offer in order to improve the program in the future. The students in the focus group discussions appreciated most aspects of both workshops and described that the program should also be offered at a younger age to sensitize students before they come in contact with risks like alcohol and/or drugs and driving a car. The students suggested making the workshops more active in many aspects, especially the traffic risks workshop, which can partially explain the smaller effects seen in this workshop.

5. Limitations and Future Research

Some limitations of the current study have to be mentioned. The first limitation is that the current study only included an experimental group. As a result, it is not clear whether the effects are genuine effects and not experimenter effects, especially given that there is evidence of social desirability effects. Future evaluation studies should try to incorporate a control group, especially since there is still debate about the effects of traffic education. However, a study on different research designs for evaluating road safety programs reported that pre-post design without a control group had a satisfied prediction power compared to a quasi-experimental design with a control group [77]. Evaluations of traffic education programs with only an experimental group have shown to be effective in changing driver behavior [78] and increasing knowledge and intention to drive safely [79]. In addition, although the study design allowed for stratification according to educational categories, future research should also pay attention to socio-economic and familial influences on crash types and crash risk.

Secondly, participants in this study were already quite road safety supportive before they followed the road traffic education program, which was also the case in a similar study conducted in Flanders, Belgium [46]. This could imply that students of higher secondary schools in Belgium are generally

supportive towards road safety. The education program "Traffic Weeks" was developed to increase awareness and knowledge and positively affect the socio-cognitive variables of the participants. An alternative can be that the program's primary focus is to positively reinforce instead of increasing the knowledge, awareness, and socio-cognitive variables of students who are already road safety supportive. The future programs can include having a discussion with a focus group to create new material for the program, who provide participants with strategies and options on how to avoid risks that they have encountered (e.g., peer pressure). These focus groups can also be included to increase the appreciation level in order to tailor the program according to the needs of participants (e.g., to increase the appreciation level of students of occupational education) so that they benefit more from the program. Focus groups are a widely adopted qualitative approach in the field of traffic safety research [80–83]. They are widely used to improve performance and engagement with the students in both education and road safety research [84,85]. Hence, they can help in identifying perceptions, opinions, and experiences, specifically with the groups who did not show appreciation and did not benefit from the program.

Thirdly, in the current study, we used single items (intention, subjective norm-friends, subjective norm-family, and PBC items from traffic risks) from TPB constructs due to low internal consistency, which may have influenced the ability of the program to assess significant changes in these variables. However, single items from sub-constructs of the TPB have been used in research [86–89], and a study conducted on differences in the predictive validity of single items and multiple items has shown that there are limited differences between them [90].

Lastly, the Traffic Weeks program in its current format is a combination of various assignments and exercises in both workshops of DUI and traffic risks. Our study could not examine what the impact is of each of these individual components within these workshops. This is, to a certain degree, a limitation, particularly for those practitioners who would be interested in finding out what the contribution of the different program components (lectures, assignments, exercises) is like. As a result, we are unable to identify which specific aspects of the workshop do (or do not) work well. A study with some students taking the DUI workshop and others taking the traffic risks workshop can help understand which has a better effect in improving road safety supportive behavior. However, until now, the majority of evaluation studies have been carried out at the overall program level [56,91,92] rather than adopting a component-specific perspective.

Author Contributions: M.S.R., A.C., S.D., H.C., D.J., G.W., T.B. and K.B. prepared the study (e.g., methodology). S.D. and H.C. collected the data. A.C., K.B., and M.S.R. discussed the analyses. M.S.R. conducted the analyses. M.S.R. and A.C. prepared the manuscript. S.D., H.C., D.J., G.W., T.B. and K.B. reviewed the drafts and contributed to the final manuscript.

Funding: This research was funded by the Flemish Government.

Acknowledgments: The authors thank the higher secondary schools in Flanders, Belgium for their cooperation.

Conflicts of Interest: The authors have no conflict of interest related to this manuscript or the research upon which it was based.

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