JECH
Journal of Education and Community Health
J Educ Community Health, 2022; 9(3):176-183. doi:10.34172/jech.2022.26
http://jech.umsha.ac.ir

Original Article

The Role of Education in Promoting Safe Motorcycle Riding Behaviors Among Iranian Students: An Application of the Protection Motivation Theory and the Information-Motivation-Behavioral Skills Model

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Article history:
Received: 29 October 2021
Accepted: 4 January 2022
ePublished: 30 September 2022

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Abstract

Background: Considering the influential role of teaching safe behaviors in preventing accidents and injuries, this study aimed to determine the effect of educational intervention based on the protection motivation theory (PMT) and information-motivation-behavioral skills (IMB) model on promoting safe motorcycle riding behaviors in male students at Sabzevar University.

Methods: This quasi-experimental study was performed on 100 motorcyclist students at Sabzevar University selected using a two-stage cluster sampling method in 2018. After confirming the validity and reliability of the instrument, the questionnaire was completed three times before, immediately, and two months after the educational intervention. The intervention group was held in 9 educational sessions for three weeks. The data were analyzed by SPSS18 software using *t* test, chi-square, Fisher's exact test, and repeated measures tests.

Results: The mean scores of PMT and IMB and safe behaviors of students in the intervention group immediately and two months after the educational intervention compared to the control group demonstrated a statistically significant increase ($P<0.001$). The mean scores of the studied constructs and safe behaviors in the intervention group also represented a statistically significant change over time ($P<0.05$).

Conclusion: The results indicated the effect of educational intervention based on PMT and IMB on promoting safe behaviors in young students. Face-to-face education and virtual education based on a combination of health education theories can be used to effectively promote safe behaviors of motorcyclist students.

Keywords: Education, Motivation, Motorcycles, Behavior

Please cite this article as follows: Mehri A, Hosseini ZS, Davarzani A, Barati H, Joveini H, Shahrabadi R, et al. The role of education in promoting safe motorcycle riding behaviors among iranian students: an application of the protection motivation theory and the information-motivation-behavioral skills model. J Educ Community Health. 2022; 9(3):176-183. doi:10.34172/jech.2022.26

Introduction

Car accidents are one of the leading causes of death worldwide. According to the World Health Organization, between 20 and 50 million people are disabled as a result of traffic accidents (1). Accidents are currently the eighth leading cause of death in the world, and the 15-29 age group is the most affected group by motorcycle accidents (2). A car accident is the third leading cause of death in Iran after cardiovascular disease and stroke. Three to four hundred thousand people die as a result of motorcycle accidents (3). Motorcycle accidents account for 42% of accidents in Iran (4), and traffic accidents are the second leading cause of death in Sabzevar (5).

The motorcycle is a type of motor vehicle that is of great importance due to its low price, low fuel consumption, high maneuverability, and less road space (6). In high-income countries, the death toll from motorcycle accidents is 5%-18%. However, in low- and middle-income countries, the death rate caused by high motorcycle ownership and accidents is high (7). The highest proportion of victims of motorcycle accidents belongs to urban and rural areas (8,9).

High-risk behaviors such as mental imbalance, lack of adequate training and skills, disregard for traffic rules, alcohol and drug use, and failure to use safety systems, including seat belts and helmets, are the most important human factors in the occurrence of accidents (10). Men as a productive force of society have a key role in the national economy and per capita income, which can

help the economy of the family and society in addition to psychological and physical effects on the injured (11). Zare et al emphasized the effective role of education in the use of safety equipment such as helmets, clothing, gloves, and shoes for motorcyclists (12). The use of safety equipment and helmets reduces the risk of death (13). In this regard, one of the best ways to reduce unsafe behaviors is through educational interventions. The effectiveness of educational interventions and health education programs requires the correct and appropriate use of theories and models of health education (14). Many studies have pointed to the effective role of the protection motivation theory (PMT) and information-motivation-behavioral skills (IMB) model in the use of safe and healthy behaviors (15,16). In the PMT, threat appraisal depends on several factors, including the severely problematic (perceived severity) nature of one's belief, estimation of the individual's risk of developing the disease (perceived vulnerability), and one's belief in the positive aspects of unhealthy behaviors (perceived reward). Thus, if perceived severity and vulnerability are high and the perceived reward is low, there will be a stronger motivation to engage in health-promoting behaviors. In the PMT, coping appraisal involves evaluating the effectiveness of protective behavior in dealing with a threat (response effectiveness), including belief in one's ability to manage protective behaviors (self-efficacy), the individual's estimation of costs (including money, time, and energy), and efforts to perform protective behaviors (response costs). It is expected to enhance the effectiveness of the response and the self-efficacy of the coping appraisal, while it is expected to reduce the response cost. Fear mediates between perceived vulnerability, perceived severity, and threat appraisal. Accepting the recommended safe behavior is assumed to be a direct act of motivation to protect oneself. To be called protective motivation, perceived severity, vulnerability, self-efficacy, and response efficiency must overcome fixed costs and rewards (17). The IMB model assumes that the implementation of a health promotion behavior is a function of the individual's full awareness of the behavior, the motivation to engage in the behavior (e.g., having a positive behavior), personal intentional attitude toward behavior, and social support of behavior, and has appropriate behavioral skills to perform the behavior (18). Due to the lack of theory-based educational interventions among motorcyclists in Sabzevar, this study sought to determine the effect of face-to-face and virtual educational interventions on preventing students' unsafe motorcycle riding behaviors based on a combination of these two models in Sabzevar in 2018.

Materials and Methods

The present quasi-experimental study was conducted among male students of Sabzevar universities (Islamic Azad University, Imam Khomeini Technical University, Hakim Sabzevari University, University of Medical Sciences, the University of New Technologies, and Comprehensive University of Applied Sciences) in 2018, and the research community included all male students of Sabzevar universities. The estimated sample size was based on the study by Mahmoud Abad et al (19) and the following formula.

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

$\mu_1 = 95.26$, $\mu_2 = 88.81$, $5.48 = \delta_1^2$, $13.47 = \delta_2^2$, power = 0.8, and $\alpha = 0.05$

Taking into account 25% of falls, the sample size in each group was estimated to be 50 people. The samples were selected using a two-stage cluster sampling method so that two universities were randomly selected from the six universities in Sabzevar. Then, 50 subjects were randomly selected from each university. The researcher identified the subjects among those who parked their motorcycles in the parking lot of universities, and they were asked to introduce other motorcyclist students. A list of all motorcyclist students was prepared, and their contact numbers were obtained as well. Overall, 100 students, who had consent to participate in the study, were selected from 2 selected universities and were included in the intervention (n = 50) and control (n = 50) groups after completing the questionnaire. After receiving the code of ethics, the researcher explained to the participants how to perform the plan, the confidentiality of information, and the purpose. The students entered the study after giving informed consent (Figure 1). The inclusion criteria consisted of being in the age range of 18-35 years, having a motorcycle, being a student of the target university, having at least one semester to the end of the study, having a mobile phone, having the ability to use cyberspace to read written texts, and having at least one year of motorcycle driving experience. On the other hand, the exclusion criteria included expressing dissatisfaction to continue cooperation, absence of more than two sessions in educational sessions, and incomplete questionnaires.

The questionnaire had three parts. The first part was related to demographic characteristics, including marital status, the number of family members, monthly family income (Toman), age, place of residence, having a certificate, and parents' education level. This part also included questions such as "Do you have a history of being fined for riding a motorcycle?" "Do you have a motorcycle license?". The second part of the questionnaire contained the subscales of the PMT and IMB model. The perceived vulnerability had 7 questions such as "There is a possibility of a motorcyclist crashing at any moment while driving a motorcycle" with a range of 7-35. Perceived severity had 6 questions such as "There is a possibility of death following a motorcycle accident" and self-efficacy had 6 questions such as "I can use a helmet to prevent the complications of a motorcycle accident". Perceived cost included 6 questions such as "Visually restrictive helmet" and motivation had 6

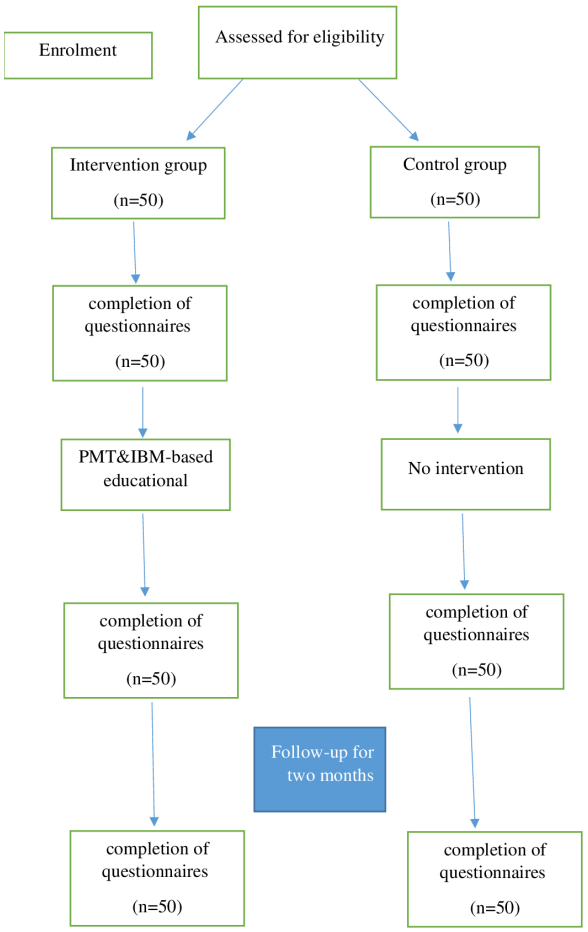

Figure 1. Steps of Implementing the Research Plan. *Note*. PMT: Protection motivation theory; IBM: Information-motivation-behavioral skills

questions such as "From now on, I intend to use a suitable and standard helmet" with a score range of 6-30. Response efficiency and fear each had 4 questions, including "Wearing a helmet reduces the risk of brain injury for the rider" and "I'm afraid of being fined", respectively, with a score range of 4-20. Perceived reward contained 5 questions such as "I enjoy riding a motorcycle at high speed" with a score range of 5-25. The subscales of the IMB model had 7 questions such as "I know the allowable speed in different parts of the city" with a score range of 7-35, and behavioral skills included 6 questions such as "I check my motorcycle periodically once a month" with a score range of 6-30. Further, motivation had 5 questions such as "I feel safer by following the traffic rules" with a score range of 5-25. The answers of the studied constructs were categorized based on a 5-point Likert-type scale from strongly disagree (1 point) to strongly agree (5 points). The third part of the questionnaire had 5 questions related to the domain of safe behaviors, and the answers always ranged from 5 to 1 (never).

To have face validity, a face-to-face interview was conducted with ten 18-35-year old motorcyclist students. For example, in the case of a perceived severity construct, the question was "What are the consequences of a motorcycle accident for you?", and the most critical factors were identified after analysis. In this study, the validity of the questionnaire was based on the opinions of 11 experts in health education and health promotion. The content index score of the present study was calculated as 0.70-0.79. It was found that the effect of overt and covert variables was also significant in the majority of constructs ($P < 0.05$). The Cronbach's alpha coefficient was obtained for perceived vulnerability (0.76), perceived severity (0.85), perceived reward (0.76), fear (0.71), self-efficacy (0.9), response efficiency (0.87), perceived cost (0.79), information (0.87), motivation (0.94), and behavioral skills (0.70). To determine the internal stability coefficient of the questionnaires among 30 selected motorcyclist students, who were not in the final study, the range of stability coefficient values obtained in the present study was between 0.78 and 0.91.

The educational content for the intervention group was adjusted after determining the most important predictors of preventive behaviors through multiple regression tests. They included the constructs of perceived vulnerability, perceived severity, self-efficacy, fear, information, behavioral skills, and motivation. Then, the target group was randomly divided into control and intervention groups. In the intervention group, two sessions were held every week for nine sessions of 1.5 hours with the presence of a health education and health promotion specialist. A meeting was held at the university meeting hall, and various educational methods were used according to the target constructs, including group discussion, brainstorming, lectures, questions, and answers, which consisted of educational materials such as film screenings. Educational posters and booklets (Table 1) were employed as well (17). Moreover, the intervention group was divided into two groups of 25 people to participate in educational sessions.

Post-test was performed by redistributing the questionnaire immediately and two months after the educational intervention for both control and intervention groups.

Mean (standard deviation, SD) was used to describe quantitative variables according to conditions, and frequency report (percentage) was applied for qualitative variables. Data were analyzed using an independent *t* test, chi-square, Fisher's exact test, and repeated measures analysis of variance (ANOVA). The significance level was considered less than 0.05.

Results

The mean (SD) age of study participants was 19.17 (±2.34) years. Most students (90%) were single, 47.8% of motorcyclist students had never worn a helmet while riding a motorcycle, and 30.4% of them had no driver's license. Moreover, 57.6% of the subjects used a mobile phone while riding a motorcycle, and more than 21% always went through a red light. The most common reason for students being fined by the police was not wearing a helmet (33%) and unauthorized speed (21%). Approximately 77% of motorcyclist students had a

driver's license. The duration of motorcycle use in 44% of the target population was three years. There was no statistically significant difference between the two groups regarding demographic variables before the educational intervention ($P > 0.05$, Table 2).

Although the mean scores of the constructs before the educational intervention were not statistically significant between the two groups, the independent *t* test showed that the mean scores of the constructs and safe behaviors immediately and between the two groups had a statistically

Table 1. Educational Program in the Intervention Group

Sessions	Objectives	A Summary of Topics and Activities	Education Time
First	Increasing perceived vulnerability	- Providing explanations about the rules and regulations of the training sessions, the purpose of the study, and the duties of the participants - Reporting statistics related to the incidence of accidents in motorcyclists - Discussing young people's misconceptions about not being vulnerable to unsafe behaviors	90
Second	Increasing perceived severity	- Explaining the lasting problems caused by accidents on motorcycle riders - Playing clips of the side effects and consequences of not observing safe behaviors in young people	90
Third	Reducing perceived rewards	- Using the brainstorming method to express the perceived rewards of not using safe behaviors and providing the necessary solutions	90
Fourth	Increasing fear and response efficacy	- Stating bitter experiences caused by a motorcycle accident by a student invited to the meeting - Brainstorming on how to use safe behaviors while riding a motorcycle - Providing pamphlets on all safe behaviors on motorcycles	90
Fifth	Reducing perceived costs	-Discussing barriers to using safe behaviors and how to overcome them - Discussing the positive and negative feelings of participants in the use of safe behaviors	90
Sixth	Increasing motivation and self-efficacy	- Displaying educational clips to teach step by step how to use safe behaviors for students	90
Seventh	Increasing information	- Explaining necessary information about the driving rules and safe speed of the motorcycle - Providing pamphlets and educational tracts on traffic rules for motorcyclists	90
Eighth	Increasing behavioral skills	Discussing the required skills to assess the safety status of the motorcycle	90
Ninth	- Summarizing and reviewing the material mentioned in the previous sessions on how to use safe behaviors while riding a motorcycle.		90

Table 2. Demographic Variables Between the Two Groups Before the Educational Intervention

Variable	Group	Control Group (n = 50)		Intervention Group (n = 50)		*P* Value
		Number	Percent	Number	Percent	
Marital status	Single	43	91.48	40	88.88	0.675
	Married	7	8.52	10	11.12	
Number of family members	Two	0	0	8	66.6	0.358
	Three	2	4.25	17	37.77	
	Four	22	42.22	10	22.22	
	Five and more	26	57.77	15	33.33	
	No	26	28.30	23	9.80	
Monthly family income (Toman)	<0.5 million	6	8.51	1	2.22	0.122
	0.5-1 million	5	10.63	14	22.22	
	>1 million	39	80.85	35	82.22	
Age (y)	18-20	24	44.86	33	73.33	0.132
	21-23	13	27.65	8	6.66	
	≥24	13	27.65	9	20	
Location	Suburbs	8	63.10	11	33.13	0.469
	City	42	36.89	39	66.86	
Having a certificate	Yes	35	43.37	36	43.37	0.893
	No	15	56.63	14	56.63	
Father's education	Illiterate	0	0	8	7.60	0.217
	Elementary and middle school	19	18.50	22	21.70	
	High school and diploma	26	27.20	17	16.30	
	Above diploma and university	5	5.40	3	3.30	
Mother's education	Illiterate	3	6.38	7	8.88	0.316
	Elementary and middle school	24	44.68	25	55.55	
	High school and diploma	14	29.78	12	20	
	Above diploma and university	9	19.14	6	11.11	

significant difference two months after the educational intervention ($P<0.05$). The results of the repeated measures ANOVA demonstrated that the mean scores of the constructs and safe behaviors in the intervention group had a statistically significant change over time ($P<0.05$, Table 3).

Discussion

According to the findings, nearly half of the participants had never worn a helmet at all, and the lack of a helmet and speeding was the main reason for students being fined. In another study, it was reported that nearly 64% of motorcyclists did not observe the speed limit while driving. The results of studies by Mokhtari et al and Oruogi et al (20, 21) on motorcyclists are in line with those of the present study. However, Li et al found that more than 90% of motorcyclists wear helmets. The reasons for the inconsistency with the present study are differences in the geographical area, sample size, and survey method (22). It seems that performing theory-based educational interventions in a codified way is highly effective. By acquiring the necessary skills, performing safe behaviors while driving becomes a part of students' lifestyles and traffic culture.

Table 3. Comparison of the Effectiveness of Intervention Program Based on the PMT and IMB Before, Immediately, and Two Months After the Intervention Between the Two Groups

Variables		Before Intervention	After Intervention	Two Months After Intervention	*P* value**
		Mean ± SD	Mean ± SD	Mean ± SD	
Perceived vulnerability	Control	25.25 ± 3.34	25.19 ± 3.66	24.95 ± 3.50	0.325
	Intervention	25.51 ± 2.67	33.24 ± 1.29	33.71 ± 1.19	<0.001
P value*		0.338	<0.001	0.004	
Perceived severity	Control	22.42 ± 3.61	22.34 ± 3.54	22.34 ± 2.54	0.341
	Intervention	24.64 ± 3.17	27.76 ± 1.50	28.51 ± 1.50	<0.001
P value*		0.356	<0.001	0.002	
Self-efficacy	Control	22.95 ± 2.48	22.78 ± 2.61	22.78 ± 2.51	0.221
	Intervention	23.97 ± 4.57	27.68 ± 1.68	28.06 ± 1.61	<0.001
P value*		0.139	<0.001	<0.001	
Response efficiency	Control	15.78 ± 2.04	15.61 ± 2.25	15.66 ± 2.65	0.237
	Intervention	17.36 ± 2.67	18.82 ± 1.09	19.00 ± 1.02	<0.001
P value*		0.256	0.002	0.003	
Cost	Control	20.95 ± 4.41	20.36 ± 5.15	20.51 ± 4.33	0.265
	Intervention	23.37 ± 1.04	28.44 ± 1.28	28.95 ± 0.97	<0.001
P value*		0.230	<0.001	0.004	
Motivation	Control	40.44 ± 4.43	40.97 ± 7.04	40.42 ± 7.61	0.233
	Intervention	40.52 ± 10.70	52.43 ± 1.18	52.80 ± 1.53	<0.001
P value*		0.278	<0.001	0.003	
Perceived Reward	Control	16.48 ± 5.66	16.91 ± 5.11	16.92 ± 5.15	0.212
	Intervention	22.17 ± 1.61	22.95 ± 1.51	23.60 ± 1.06	<0.001
P value*		0.254	<0.001	0.002	
Fear	Control	15.10 ± 1.43	15.59 ± 3.44	15.61 ± 3.42	0.337
	Intervention	15.62 ± 4.53	19.04 ± 3.71	19.42 ± 3.61	<0.001
P value*		0.359	<0.001	<0.001	
Information	Control	15.57 ± 5.31	17.50 ± 5.48	17.50 ± 5.61	0.326
	Intervention	17.62 ± 4.31	24.42 ± 2.61	24.22 ± 3.51	<0.001
P value*		0.339	<0.001	0.004	
Behavioral skills	Control	21.64 ± 3.29	21.62 ± 3.19	21.80 ± 3.31	0.127
	Intervention	23.02 ± 3.61	29.24 ± 1.20	26.42 ± 1.61	<0.001
P value*		0.232	<0.001	0.002	
Behavior	Control	23.76 ± 4.93	23.72 ± 4.81	24.10 ± 4.65	0.353
	Intervention	20.24 ± 4.58	27.31 ± 4.91	34.17 ± 3.01	<0.001
P value*		0.338	<0.001	0.004	

Note. PMT: Protection motivation theory; IBM: Information-motivation-behavioral skills.
*P values obtained by comparing differences in the variable values between the two groups using independent t-test; **P values obtained by comparing means in the variable values within each group using repeated measures analysis of variance.

According to the findings, immediately and two months after the educational intervention, there was a statistically significant difference in the mean score of threat appraisal between the two groups. The findings of some studies (23-25) are in conformity with the results of the present study, while Rafiei et al reported no significant difference in the perceived severity construct between the two groups after the educational intervention. Such inconsistencies in the results of some studies with those of the present study are differences in the sample size and mean age of the participants and differences in the number of the held sessions (26). During the educational sessions, the study was conducted by providing statistics and information related to the rate of accidents due to unsafe behaviors in young people and the wide consequences of these behaviors during their lives, as well as inviting people who suffer from injuries caused by using unsafe behaviors. The students also expressed the most important rewards they received for performing unsafe behaviors, and then necessary solutions were provided to them through a group discussion.

The results of this study revealed a significant increase in the mean score of coping appraisal immediately and two months after the educational intervention in the intervention group. The mean scores of perceived response efficiency and perceived self-efficacy increased after the educational intervention. However, the costs of performing safe behaviors while riding a motorcycle in the intervention group decreased significantly compared to the control group. The results of some studies by Mirkarimi et al, Baghiani Moghaddam et al, and Bai et al (27-29) are consistent with this finding. Conversely, Dehdari et al did not report a statistically significant change in the mean scores of perceived response efficiency and perceived cost between the two groups after the educational intervention. It can be attributed to the difference during the educational intervention, the type of research, and the study population (30). Participants in the study of Orouji et al stated that the most critical barriers to not wearing a helmet while riding a motorcycle are sweating, hearing impairment, high cost, heaviness, and visual impairment (31). In the present study, using the method of brainstorming, the participants attempted to name their most essential obstacles in using safe behaviors while riding a motorcycle. In return, practical solutions to overcome these obstacles were presented to them. The advantages of safe behaviors in preventing traffic accidents were discussed during the educational sessions.

The present study results showed a significant increase in the mean scores of the information and behavioral skills of students immediately and two months after the educational intervention in the intervention group. In the study by Foster (32), the educational intervention mean scores of information and skills of AIDS-preventing behaviors in truck drivers increased significantly. Anderson et al also found that the level of motivation and behavioral skills increased after educational interventions (16). It was due to the fact that before the educational intervention, students did not know enough about the consequences of unsafe behaviors while riding a motorcycle (e.g., high speed, dramatic movements, lack of helmets, and the like). During the educational sessions, various educational methods, posters, educational pamphlets, and clips were used to increase their information, and each of the skills required to apply safe behaviors was addressed as well.

According to the findings, the mean score of motivation and self-efficacy of students immediately and two months after the educational intervention in the intervention group was significantly higher than in the control group. Numerous domestic and foreign studies confirmed the effect of educational intervention on improving motivation and self-efficacy (33-36). Soltani et al emphasized the influential role of self-confidence and self-efficacy in using safe behaviors in front seat passengers (37). A high sense of self-efficacy will lead to more effort and flexibility to perform safe behaviors more effectively while riding a motorcycle.

According to the results, only 5% of the participants always wore helmets before the educational intervention, and other safe behaviors of the students in the present study did not have the desired level before the educational intervention. This result is in line with the finding of a study by Shahbazzadeh et al, in which 12.6% of Ardabil motorcyclists used helmets (38). In the present study, immediately and two months after the educational intervention, the mean scores of safe behaviors of students in the intervention group were significant compared to the control group. It makes sense when students receive structured educational programs to increase the right information and raise their awareness of safe behaviors and ways to overcome barriers to safe behaviors and their ability. Knowing how to overcome obstacles, believing in them, and using behavioral skills and tools can lead to safe behaviors (39-41).

One of the limitations of the present study is the completion of a self-report questionnaire. Another limitation was the interference of students' classroom programs with the program of educational intervention sessions, which the researcher tried to overcome through written planning. The simultaneous use of two structured theories during educational sessions and the use of face-to-face education, along with virtual education are among the advantages of this study.

Conclusion

Based on the study results, educational programs based on PMT and IMB could effectively promote safe behaviors in young students. The use of face-to-face education and virtual education combined with the theory of health education and the application of various educational methods will effectively promote the safe behaviors of motorcyclists.

Acknowledgments

Thanks are owed to all students who participated in this study.

Authors' Contribution

Methodology: MA; Investigation and Validation: AD; Writing-Original Draft Preparation: ZSH; Formal Analysis: HB; Writing-Review and Editing: HJ; Data Curation: RS ;Supervision: MH.

Conflict of Interests

The authors declare that there is no conflict of interest.

Ethical Permissions

The Research Ethics Committee of Sabzevar University of Medical Sciences approved this study with the ID: IR.MEDSAB.REC.1397.057.

Funding/Support

This article is retrieved from the research project approved by Sabzevar University of Medical Sciences with project number 97092, which was supported by Vice-Chancellor for Research and Technology of this university.

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