



The Role of Environmental Education in Increasing the Awareness of Primary School Students and Reducing Environmental Risks

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ABSTRACT

Introduction: Primary schools are children's first social environments. Other people's attitudes towards environmental hazards play a key role in developing children's personality. This study aimed to identify and assess the environmental risks (such as emission of pollutants into the air, discharge of pollutants into water and soil, energy consumption, etc.) in Shohadaye Kork female primary school in Kashan, Iran, and also to investigate the role of environmental education in the promotion of students' environmental knowledge.

Materials and Methods: In this quasi-experimental study, at first, environmental hazards were identified by a checklist through field visits and observing students' activities, and then they were assessed through Preliminary Hazard Analysis (PHA) method. After that, the Risk Assessment Code 1 (RAC1) was calculated. By Considering the involved hazards, environmental education was presented and then RAC2 was calculated. Environmental awareness of 172 students was investigated by a questionnaire. SPSS V 19 was used for statistical analysis.

Results: 26 environmental hazards were identified, including 22 acceptable and 4 unacceptable (critical) hazards; 21 of them could be directly resolved by proper education. The mean scores of students' environmental tests were 5 and 18.21, respectively before and after the education. After taking control of measures all hazards were placed within the acceptable range.

Conclusion: Schools environmental management plays an important role in preparing students for environmental education that the results of this study showed a significant relationship between education and promotion of students' environmental awareness.

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Introduction

In many cases, the foundations of national school courses are directly or indirectly based on the environmental issues. As the frontline in the field of human education, schools play a key role in culture and education; therefore, their high potentials should be used efficiently. Applying the early scientific method of observation along with their senses, students and families, more or less, understand the silence of the nature. Firstly,

environmental problems have adverse consequences on humans' personal health and, secondly, they affect the economic, social, and cultural developments. As a result, public concern about environmental hazards is growing. Human activities and environmental changes are directly correlated and many human activities are affected by environmental changes. On the other hand, these changes lead to negative consequences, especially for humans' health and most importantly children¹⁻².

Therefore, all countries and nations are responsible for eliminating or at least reducing these effects and turning them into less destructive ones¹. Since these problems are merely man-made, educating the community, promoting the public culture, and legislating appropriate laws are the most effective solutions³. The risk management process consists of three main parts of process identification, risk assessment, and risk reduction to an acceptable level⁴. Risk assessment includes identifying risks in a process or business, calculating the risk number, and offering appropriate control measures⁵. Hazard is the potential of an agent to generate a specific type of harmful effect in health or the environment⁶ and risk is defined as the probability of the occurrence of a hazard. The definition of a risk is closely related to the probability of that risk⁴. Risk is the probability of a hazard and its severity that causes damage. Accordingly, risk is not a fixed quantity and it is constantly changing. In fact, when the risk is assessed, the probability of the hazard and its consequences are interpreted based on environmental conditions⁷. Preliminary Hazard Analysis (PHA) is a semi-quantitative system analysis that is used for assessing and documenting the risk of the hazards of new or modified systems⁸. Environmental hazards are not considered natural, but the phenomena that have directly resulted from human activities. Natural phenomena only distribute and intensify them. In recent years, most communities have become interested in and concerned about the effect of environmental issues in future development. In addition to technical aspects of environmental health and risks, attempts at intended processes, as well as health and lifestyle concerns have made it more difficult to succeed in environmental projects and risk management⁹. Environmental awareness should be transferred to the community in such a way that environmental issues can always raise public concern. The purpose of environmental education is training citizens that try to protect the environment and prevent its destruction through their knowledge and actions^{3,10}. Young students can be trained properly in any fields; specifically in energy consumption management and transfer the appropriate patterns of

consumption to their homes and community. By teaching the appropriate strategies of consumption management to the students, according to their age, correct behaviors can be introduced to their homes.

Thereby, the best and most accurate consumption patterns can be established in the society. Shahvali et al. studied the environmental knowledge of students in Kish island¹¹. The results indicated that the students' average level of environmental awareness has improved by providing them with more environmental information. The researchers concluded that this fact demonstrates the need to improve their environmental education because their socioeconomic development depends on the changes in their behavior towards the environment and natural resources¹¹. Salehi studied 715 residents of the provinces of Gilan, Mazandaran, and Golestan¹². The results showed that while their environmental knowledge was low, their environmental behavior was high. He believes that the lack of appropriate environmental education is not only the problem of formal education, but it can also be observed in non-formal education. In other words, from primary school to high school, no one receives proper environmental education¹². In 2007, Nouri et al. used FMEA method to identify and assess the environmental risks of activities and services of Science and Research University¹³. According to the results of risk assessment, natural events such as lightning, surface water pollution, solid waste generated by earthquakes and floods, air pollution caused by leaking gas pipes or fire during earthquakes or explosions in installation process, underground water pollution caused by producing and disposing hygienic and laboratory sewage, destruction of natural resources, and also waste production of the master plan were identified as high risk. The results indicated that managing, organizing, directing, and controlling the activities and services of universities reduce environmental risks. In addition, assessment and risk management can play an important role in controlling the potential risks¹³. Cavas et al. used the data of science education test to study the views of Turkish students on the environmental issues, based on their sex¹⁴. The results show that students have compatible and

favorable attitudes towards environmental issues. They are interested in finding solutions to environmental issues and show optimistic interest towards the future. Their interest in learning about the environment is average and, depending on their sex, there are significant differences in their attitudes and interests towards the environment¹⁴. The results of previous studies state that there is a significant positive relationship between the level of environmental awareness, attitude, and environmental behavior so that education and knowledge of environmental issues are the variables that influence on environmental attitude. In contrast, some studies failed to find any significant relationship between these two variables¹⁵.

In this study, environmental hazards in Shohadaye Kork female primary school were identified by a checklist while the risks were assessed by PHA. Afterwards, the role of education, as a means of control, in increasing environmental knowledge of 172 students was studied in the fifth and sixth grade. Failure Mode and Effect Analysis (FMEA): It is an analytical method in risk assessment that seeks to identify and rank the potential risks in the area where the risk assessment is carried out, as well as its causes and effects as far as possible.

Materials and Methods

This cross-sectional study was conducted during a 6 months period of time from October 2013 to April 2014 in Shohadaye Kork female primary

school. This study included two parts. The first part studied environmental management that involved the cycle and the process of environmental risk assessment in this primary school while the second part dealt with the training of students and their familiarity with environmental hazards. In the first step, after identifying and assessing environmental hazards in different sections and facilities of the school by a checklist, control measures were provided through consulting with experts in environmental health engineering. Environmental hazard risk assessment was performed using a PHA. PHA method is the first serious attempt to identify the hazards of a system and can be the basis for hazard control¹⁶. In general, there are four basic steps of PHA including: 1. PHA requirements (determining the PHA team, defining and explaining the analyzed system, collecting information about previous and similar systems); 2. identifying hazards; 3. estimating the consequence and probability; 4. risk ranking and follow-up measures¹⁷.

To assess the hazards in PHA method, hazard severity and the probability of occurrence were ranked for each of the activities and facilities (Table 1). Hazard score (risk rating) was calculated by multiplying the above factors through the following formula:

Risk rating = probability of occurrence × hazard severity

Table 1: Description of the severity and probability of the environmental hazard¹⁸

Severity of the hazard	Probability of the hazard	Scores
Irreversible environmental damage with long-term effects; excessive consumption of resources and energy; excessive concentration of pollutants.	It is often likely to occur; it occurs daily or weekly; it is uncontrollable.	5
Irreversible environmental damage with medium-term effects; high consumption of resources and energy; high concentrations of pollutants.	The probability is 50%; its occurrence is possible; it occurs monthly; extraordinary power is needed to control the expenses.	4
Irreversible environmental damage with short-term effects; moderate consumption of resources and energy; excessive concentration of pollutants.	It may occur accidentally; the probability is less than 50%; it occurs several times a year; it can be controlled on the surface.	3
Irreversible environmental damage with long-term effects; relatively low consumption of resources and energy; excessive concentration of pollutants.	It may not occur until a few years after contact; its occurrence is possible; it occurs rarely; it can be controlled at the source.	2
Irreversible environmental damage with short-term effects; low consumption of resources and energy; standard concentration of pollutants.	It is practically impossible to occur; it never occurs.	1

After calculating the initial environmental risk number for each environmental hazard (between 1 to 25), the risks were categorized into 3 levels, including acceptable (risk number below 8), intermediate (risk number between 9 to 20), and unacceptable or severe (risk number 20 to 25). Then essential corrective measures against identified environmental hazards were presented and secondary risk number (RAC2) was calculated after 5 months. Corrective measures included some items such as holding practical and theoretical courses of environmental education, supplying equipments and containers for waste storage, establishing waste management system, technical and maintenance operations, installing low-flow faucets, installing a drip irrigation system, etc.

Presented environmental education consisted of basic and simple knowledge about air pollution, discharge of pollutants into water and soil, waste hazards, methods of saving water and energy, the importance of recycling, green space, preventing damage to natural resources, etc. The second part studied the environmental knowledge of 172 students of 5th and 6th grades in Shohadaye Kork female primary school. Since the understanding of the students in the fifth and sixth grades of this school was greater than the understanding of lower grade students, they were selected as the samples of this study. At first, an environmental test was taken to check the level of students' environmental knowledge. Then environmental hazards in the school were introduced to the students as a plan using educational media such as films and boards along with field visits. After that, the test was taken again. By studying carefully and interpreting the strategic goals of the book of the Comprehensive Environmental Charter of Schools, published by Environment Protection Organization and applied to the students from pre-school to high

School¹⁹, the test was decided to include 20 multiple choice questions (Table 2). In the end, SPSS V 19 was used for statistical analysis and the

relationship between these variables was studied in the significant level of 0.05, using statistical tests like paired T-test. It is worth mentioning that the education was performed before presenting control measures against environmental hazards.

Results

26 environmental risks resulting from the activities and facilities were recognized in Shohadaye Kork female primary school and were categorized into 6 groups (Table 3). PHA was applied to assess the risk of each hazard and study the role of education in eliminating it. According to Table 2, in 78% of cases, environmental education has a significant effect on the prevention, control, and elimination of environmental hazards. The highest score of the initial risk assessment of environmental risk is related to the frequent washing of the school with a hazard score of 25, while the lowest secondary risk assessment score is related to the dispersion of the smell of distributed spoiled milk in classrooms with a score of 4. After corrective measures, a significant difference was observed in the reduction of secondary risk assessment. The highest secondary risk assessment score belonged to the environmental risks of the dispersion of dust due to monsoon and the noise caused by construction activities in school, each with a hazard score of 12 that were left unchanged because they were not controlled by human factors associated with the school. The lowest secondary risk assessment score among 11 environmental risks is obvious with the score of 2. The results showed that the mean and standard deviation of initial risk assessment code was 11.57 ± 5.83 and the mean and standard deviation of secondary risk assessment code was 4.73 ± 3.32 (Figures 1 and 2). In the next step, without separating the environmental hazard groups, risk assessment code was studied before (RAC1) and after (RAC2) corrective measures using paired T-test and a significant difference was observed between RAC1 and RAC2 ($R < 0.001$).

Table 2: Environmental test questions in Shohadaye Kork female primary school, Kashan

No.	Environmental test question	Number/Person of	Number/Person of
		correct answers Before education	correct answers after education
1	Which one is the most important air pollutant?	52	168
2	How does wasting water affect environmental degradation?	23	169
3	In which part of the school is water wasted more?	65	165
4	In which part of the school is water leakage large, but undetectable?	12	170
5	What is the most important environmental action after the end of class?	80	172
6	What kind of environmental pollution does the school bell cause?	35	172
7	Which of the following steps is helpful for waste disposal?	55	168
8	What is the best environmental action about sewage?	20	160
9	What is the appropriate strategy for sewage leakage control?	15	164
10	Does maintaining human health depend on the health of personal instrument?	75	172
11	What is the best environmental action before leaving classrooms?	15	172
12	What is the environmental hazard of leaving the heater on after the end of class?	34	160
13	What are the important sources of wasting energy in school?	54	100
14	How does waste leachate harm the environment?	10	100
15	Which environmental hazard does paper dispersion cause in school?	97	105
16	How do plants and green spaces help environmental protection?	95	170
17	What is the best method for irrigation of green spaces?	20	162
18	How does frequent washing of the school yard harm the environment?	56	164
19	What are the most important environmental hazards of schools?	10	150
20	What does the environment include?	37	170

Table 3: Initial and secondary risk assessment of environmental hazards identified in Shohadaye Kork female primary school, Kashan

Number	Environmental risks group	Environmental hazards	Initial risk assessment			The direct impact of education	Secondary risk assessment		
			Severity	Probability	RAC1		Severity	Probability	RAC2
1	Water loss	Leaking faucets of school green space	2	4	8	+	1	2	2
		Leaving faucets open	3	4	12	+	2	1	2
		Leaking faucet of bathrooms	3	3	9	+	2	2	4
		Leaking faucets of water cooler	2	3	6	-	1	1	2
		Washing the school frequently	5	5	25	+	2	2	4
		Flood irrigation of gardens	4	5	20	+	1	2	2
2	Production and dispersion of waste	Dispersion of waste in classrooms	2	3	6	+	2	2	4
		Dispersion of waste in school yard	3	2	6	+	2	2	4
		Leakage of leachate from waste	3	3	9	+	2	1	2
		Not putting waste in nylons	2	3	6	+	2	1	2
		No place for waste depot	4	4	16	-	2	2	4
3	Sewage emission into the environment	Sewage leakage in kitchen	3	3	9	+	2	1	2

4	Emission of pollutants into the air	Dispersion of the smell of depot waste in school environment	3	3	9	-	2	2	4
		Dispersion of the smell of leftover bread and fruit in classrooms	2	4	8	+	2	1	2
		Dispersion of the smell of distributed spoiled milk in classrooms	2	2	4	+	2	1	2
		Emission of the smell of gas in classrooms	2	3	6	+	2	1	2
		Dispersion of dust caused by monsoons	4	3	12	-	4	3	12
5	Waste of energy	Leaving the lights on after the end of classes	3	5	15	+	3	2	6
		Leaving the coolers on after the end of classes	4	3	12	+	4	1	4
		Leaving the refrigerators on during summer vacation	4	5	20	+	4	2	8
		Leaving the heaters on after the end of classes	4	3	12	+	3	2	6
		Gas leakage from gas hoses	3	2	6	+	2	1	2
6	Noise in the environment	Noisy breaks (irritated neighbors)	5	5	25	+	4	3	12
		Noise caused by uproar in classrooms	3	4	12	+	3	2	8
		Noise caused by school construction	4	3	12	-	4	3	12
		Noise of school bell	4	4	16	+	3	3	9

Primary Risk Assessment

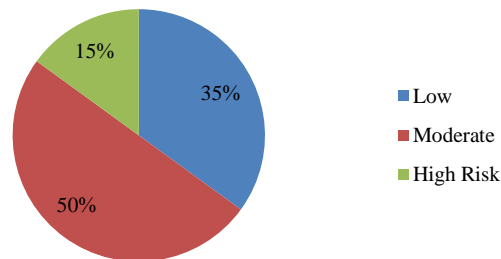


Figure 1: Comparison frequency of environmental risks in initial assessments in Shohadaye Kork female primary school, Kashan

Secondary Risk Assessment

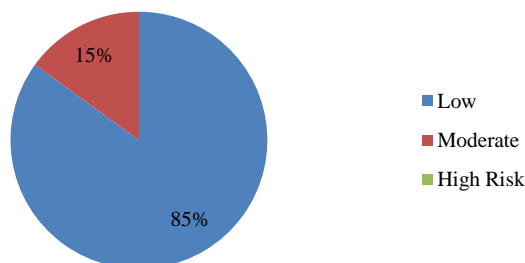


Figure 2: Comparison frequency of environmental risks in secondary assessments in Shohadaye Kork female primary school, Kashan

The results of the second step of the study indicate that the students' low-level of environmental knowledge before environmental education and tremendous increase in the level of their environmental knowledge after relevant environmental education. Initial and secondary (after education) mean test scores were 5 and 18.21, respectively. Therefore, paired T-test showed a significant difference between the scores before and after education ($P < 0.001$).

Discussion

Environmental risk management can lead to the protection and preservation of the environment and precautionary measures through appropriate strategies based on the conditions of each organization¹³. According to the results of risk assessment in Shohadaye Kork female primary school and determining the levels, environmental risks that were identified as high-level and unacceptable, include frequent washing of the school yard, flood irrigation of gardens, leaving the refrigerators on during summer vacation, and noisy breaks (irritated neighbors). They required immediate corrective solutions in accordance with the environmental risk management.

According to table 2, 50% of unacceptable (severe) environmental hazards are related to wasting water that is caused by school personnel. Despite the current environmental warnings, these hazards exist not only in schools, but in the most organizations. However, the majority of students have poor knowledge of optimal green space irrigation methods (Table 2, question 17). Furthermore, students' sound pollution is an environmental problem for the residents of adjacent areas and was assessed as a severe environmental hazard according to table 2. Locating schools accurately, separating gyms from schools, and educating students in terms of behavior can have a significant impact on reducing the sound pollution. Based on chart 1, after corrective measures, 22 environmental risks were placed in an acceptable range. This shows the positive effect of professional corrective measures. Public protection of natural resources and the environment must start with

basic education for children to encourage public participation. It is the newest and most effective method for fighting against the destruction and degradation of the nature²⁰. Given that in 78% of cases, proper education has a corrective effect on environmental hazards, it is necessary to design appropriate education along with environmental risk management, to increase students' environmental knowledge. According to the current environmental crisis and concerns, the appropriate environmental education for students can increase their environmental knowledge and help them to learn the skills of environmental protection and consider eco-friendly behaviors during their life. The present study identified environmental hazards in Shohadaye Kork female primary school through environmental risk management operations, discussed field education, and showed its significant role in increasing the level of students' environmental knowledge. It was revealed that about 70% of German children are appropriately familiar with their own environment²¹. The student's knowledge in the study of Alp et al. was similar to this study; nonetheless, these students had a positive attitude towards the environment²². According to Table 3, the results of the study showed that the students' environmental knowledge in Shohadaye Kork female primary school, located in a deprived area in Kashan, has been low; furthermore, effective education has played a significant role in promoting their environmental awareness. Correlation coefficient analysis of this study showed that there is a significant positive relationship between the knowledge of environmental issues, students' environmental visits of their own school, and watching educational videos about the environment. These findings are in agreement with the results of the study of Frik et al. stating that only practical knowledge leads to correct behavior towards the environment²³.

Conclusion

The need for various environmental educations has great importance. Considering the talents of

school-age children and the key role of schools in organizing the students' personality should be prioritized in educational programs in schools. Establishing an environmental risk management system in schools identifies environmental hazards, contributes to the students' practical environmental education, and increasing their awareness. Field visits of nature and human society, environmental activities of organizations related to health and environment in different environmental occasions, as well as introducing environmental issues increase the environmental and practical knowledge of students of Shohadaye Kork female primary school in Kashan and lead to obvious changes in their attitudes towards the environment. Due to the students' character modeling, effective relationship between national courses and environmental issues, as well as the constructive behavior of teaching staff as role-models develop the quality of their environmental knowledge.

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Conflict of interest

The authors are committed to declare that they have no competing interests.

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