

Environmental Education in Social Sciences Textbooks of Senior High Schools in Iran

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ABSTRACT

Considering the important impact of education on socializing students and preparing the new generation for roles in local, national, and international societies, the educational system is expected to pay special attention to environmental education (EE) in textbooks. The purpose of this study is to investigate the role of EE in social sciences textbooks (SST) in Iranian senior high schools. The research method used was a quantitative content analysis of all SST in senior high schools (3 volumes) during the 2017-2018 academic year. Sentences were used as the analysis unit, and textbook content was divided into four sections based on the cutting operation: text, picture, question, and activity. Shannon entropy method was used for analysing the data. The most significant results indicate that there is no balanced and comprehensive attention given to EE in senior high school SST. The most consideration for EE was found in 11th grade SST and the highest weight was related to noise pollutants and environmental protection in the Constitution.

Keywords: Environmental education, quantitative content analysis, senior high school, social sciences textbooks

INTRODUCTION

All over the world, the education system, as an organization that prepares students to enter the society, should help to solve environmental challenges in order to fulfil

its social responsibility. As part of the structure of a centralized education system, textbooks are used as the most important tool for transferring concepts, meanings, and values to students (Amini & Mashallahi, 2015).

In all countries, during recent years, environmental education (EE) has been at the centre of international and national policies. Many researchers and experts from many countries have developed significant debates on EE educational

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programming and proposed methods. However, the 1970s are epitomized by the prolific growth of EE in the world. This was an era of exuberant capacity building for the field. The momentum of the legislation and activism of the 1960s continued to build on both national and international levels (Disinger, 2001). According to some educators and scholars EE is defined as:

... A continuous activity by which the educational society takes into account the global reality, the types of relationships that human beings establish between themselves and nature, the problems which result from those relationships, and their fundamental causes. It is developed through practice which links the learner to the society, values, and attitudes that promote behaviours directed towards the transformation of that reality, in both environmental and social terms, and develops in the learner the skills and attitudes needed for that transformation'. (Teitelbaum 1978 as cited in Gaudiano, 1999)

Generally, it teaches the concept of individual responsibility and, similar to traditional education that appreciates law and order or religious education that promotes morality, this kind of education focuses on the fundamental aspects of the environment (Orr, 2009). According to Martin, it is proven that the implementation of EE in many national contexts is a complicated process:

.... if we do accept a more socially analytical approach to environmental education, this has its own problems within the formal education system. The overt or critical stance to social values and ways of life can create concerns about motivations, objectivity, and sometimes relevance to what most teachers think they ought to be doing. Using education to challenge, even alter, social attitudes and values and thereby socio-economic systems—particularly if these are preconceived—poses enormous issues of acceptability from teachers, school managers, parents, and the local and central government'. (Martin, 1996)

One of the main elements of EE, not only in a local and national view but also in a global, human, and environmental context is curriculum (Slattery & Rapp, 2002; Nussbaum, 2006). Efforts should be made to include the importance of EE, its protection, and its revival into curricula to change the learner's cognitive, effective and participatory knowledge, skills and behaviour (Carleton-Hug & Hug, 2010). EE taps into a broad range of source disciplines for its content. Science, mathematics, language arts, social sciences, politics, and philosophy make up just a part of the mix. It also draws from a broad base for its pedagogy (Carter & Simmons, 2010). The integration of EE with social studies has also attracted the attention of scholars due to the nature of this field, namely, helping

students become socialized (Shobeiri & Shamsi, 2015).

The results of a study carried out by the British Council of Environmental Education (2004) indicated that only 17 percent of schools were involved in EE, and just 2 percent of schools had adopted a strategy and plan for EE. Tomlins and Froud (2005) investigated more than 4,000 secondary school students and found that 25 percent of schools had curricula related to EE, and 42 percent of them lacked EE. According to the study that Bradley et al. (1999) carried out in Texas, USA, there are significant differences in knowledge gain and attitudes of students after exposure. Students' environmental knowledge scores increased by 22 percent after they completed the environmental science course. In addition, students' environmental attitudes became more environmentally favorable. Students having higher knowledge scores had more favorable environmental attitudes compared with students with lower knowledge scores. Omran et al. (2017) reviewed sixth-grade elementary school textbooks in Iran and concluded that there was no balanced and comprehensive attention given to EE components within the textbooks. Ali et al. (2017) investigated 1,200 secondary school students in Nigeria and the results showed that the students had low environmental awareness levels.

Iran Context

The structure of general education in Iran is centralized and compulsory education begins at 6 years old. The Organization for

Educational Research and Planning, which is under the supervision of Iran's Ministry of Education, compiles the textbooks. Iranian textbooks have changed two to three times over the last forty years. The most recent change was during the 2010-2011 academic year when the structure of the educational grades was changed. Educational grades in Iran were as three grades, included elementary (5 years), middle (3 years), and high school (3 years) which has changed to two grades, elementary (6 years) and secondary (junior high school: 3 years include 7th, 8th, and 9th grades and senior high school: 3 years include 10th, 11th, 12th grades) (Motamedi, 2012). Based on these changes, textbooks were gradually reviewed to meet the needs of both younger generations and social and international changes. The environmental issue is an important subject in Iran as environmental protection is considered as a public responsibility in Article 50 of the Constitution of the Islamic Republic of Iran; furthermore, environmental issues are implicitly included in science and social science courses in elementary and secondary schools. There is no separate curriculum for EE. However, in the 2017-2018 academic year, the textbook "Human and Environment" entered into the Iranian general education system for the first time as a textbook for the 11th grade of senior high school.

On the other hand, in the last few decades, Iran has faced serious environmental issues, such as increasing rates of air pollution in metropolitan areas (Holizadeh et al., 2009), air pollution caused by dust particles in

southern cities (Delangizan & Motlagh, 2013), deforestation, and soil erosion (Vlayati & Kadivar, 2006).

It is necessary to consider environmental issues in the formal curriculum. The social sciences textbooks (SST) are chosen for this analysis because, in recent years, environmental challenges such as increasing air pollution, continuity of droughts, shortage of water resources, and invasions of dust particles from neighbouring countries have emerged as a social issue among Iranians. SST was chosen as the target population to identify the status of EE in textbooks with the following questions in mind:

1. To what extent has EE been addressed in 10th grade SST?
2. To what extent has EE been addressed in 11th grade SST?
3. To what extent has EE been addressed in 12th grade SST?
4. To what extent is EE taken into account in senior high school SST?

MATERIALS AND METHODS

The research method is descriptive, using quantitative content analysis methods in order to evaluate senior high school SST for the main indicators of EE. The indicators of EE include environmental protection, man-made environment protection, water pollutants, soil pollutants, air pollutants, sound pollutants, industrial pollutants, environmental pollution and its relation to human life, environmental pollution and its relation to the life of plants and animals, environmental protection in the constitution.

The statistical population consists of all senior high school SST (3 volumes) in the 2017-2018 academic year. Due to the limited statistical population, sampling was discarded and the whole population (i.e. a census) was used as the sample. The content of SST was divided into four sections based on the cutting operation: text, picture, question, and activity. Next, the main indicators of EE were analysed in each of these sections. Sentences were used as the unit of analysis for text, question, and activity. The unit of analysis for pictures was the pictures themselves. After the cutting and classification operations, the calculations of selected indicators for each section were carried out. Each of these units was placed in the relevant table and the number of corresponding units was written in front of them. To assess its validity, the opinions of six experienced teachers (each with over 20 years of work experience) and two environmental experts were used, and test-retest correlation was used to measure their reliability. Therefore, after two studies on senior high school SST with a week between each study, the correlation coefficient among the counted frequencies was 0.89 which is computed as:

$$\frac{0.87 + 0.91}{2} = 0.89$$

The content of senior high school SST is based on three resources (10th, 11th, and 12th grade textbooks), the targeted concept (EE), and the components (respectively, 1. environmental protection, 2. man-made environment protection, 3. water pollutants,

4. soil pollutants, 5. air pollutants, 6. sound pollutants, 7. industrial pollutants, 8. environmental pollution and its relation to human life 9. environmental pollution and its relation to the life of plants and animals 10. environmental protection in the constitution). The Shannon Entropy Method was used to analyse the data by using EXCEL software.

Shannon Entropy

This method is based on systems theory and is well known as a compensatory model. The entropy in information theory is a standard for the uncertainty value, which is expressed by a discrete probability distribution (p_i). This is so the uncertainty value, with balanced distribution, is greater than the cases where the frequency distribution is sharp (Shannon, 1948). For the uncertainty value, we first calculate the symbol E as described below:

$$E = -K \sum_{i=1}^n [p_i \cdot \text{Ln}(p_i)] \tag{1}$$

In the above equation, the variable K is a positive constant for providing $1 \geq E \geq 0$ from the probability distribution (p_i) calculated by the statistical mechanism. If the (p_i)s are equal to each other, it has the least possible value (0.000001).

$$-k \sum_{i=1}^n [p_i \cdot \text{Ln}(p_i)] = -k \left\{ \left(\text{Ln} \frac{1}{n} \right) \left(\frac{n}{n} \right) \right\} = -k \text{Ln} \frac{1}{n} \tag{2}$$

A decision matrix contains information that indicates entropy can be used as a criterion for evaluation, as demonstrated in the matrix in Table 1.

Table 1
Decision matrix

	X_1	X_{2l}	.	X_n
A_1	r_{11}	r_{12}	.	r_{1n}
A_2	r_{21}	r_{22}	.	r_{2n}
.
.
A_m	r_m^1	r_m^2	.	r_{mn}

In the matrix shown in Table 1, A_m represents the options that need to be ranked, X_j represents the categories that the evaluated options are based on, and r_{ij} represents the value of each indicator corresponding to each option. The information obtained from this matrix (p_{ij}) is as follows:

$$p_j = \frac{r_{ij}}{\sum_{i=1}^m r_{ij}} \tag{3}$$

For E_j from the p_{ij} collection, the equations for each characteristic are:

$$E_j = -K \sum_{i=1}^n [p_{ij} \cdot \text{Ln}(p_{ij})] \tag{4}$$

$$-k = \frac{1}{\text{Ln}(m)} \tag{5}$$

Next, the uncertainty or degree of deviation (d_j) of the information created for index j is:

$$d_j = (1 - E_j) \tag{6}$$

Finally, the authors have used the existing index for weights (w_j):

$$w_j = \frac{d_j}{\sum_{j=1}^n d_j} \tag{7}$$

Finally, it can be stated that the Shannon entropy method is used to rank the different indices using the importance coefficient and this allows the scattering of important information more accurately understood.

RESULTS AND DISCUSSION

The First Question

Of the sum total of 2534 units identified for 10th grade SST, only 28 units had been allocated to EE, indicating that EE in 10th grade SST was not adequately considered. The most consideration for EE (p_{ij} = 16) was in the first chapter of this book and the highest weight (w_j = 0.18) was related to water pollutants, air pollutants, noise pollutants, industrial pollutants, and environmental protection in the Constitution. It can be concluded that the highest neglect towards EE was in these

components. EE was not a priority in 10th grade SST and a proportion of curriculum content should be included in these books (given in Table 2).

The Second Question

Of the sum total of 3212 units identified for 11th grade SST, only 62 units were allocated to EE, indicating that EE in 11th grade SST was not adequately considered. The most consideration for EE (p_{ij} = 45) was in the third chapter of this book and the highest weight (w_j = 0.14) was related to noise pollutants and environmental protection in the Constitution. It can be concluded that the most neglect towards EE was in these components. EE was not a priority in 11th grade SST and a proportion of curriculum content should be included in these books (given in Table 3).

The Third Question

Of the sum total of 3324 units identified for 12th grade SST, only 50 units were allocated to EE, indicating that EE in the 12th grade SST was not adequately considered. The

Table 2
Decision matrix of EE in SST of 10th grade

Components		1	2	3	4	5	6	7	8	9	10	p_{ij}	
Resource													
10 th grade (n= 2534)	Chapter One	3 (0.60)	2 (0.66)	1 (ε)	3 (0.75)	1 (ε)	1 (ε)	1 (ε)	1 (0.33)	2 (0.67)	1 (ε)	16	
	Chapter Two	2 (0.40)	1 (0.34)	1 (ε)	1 (0.25)	1 (ε)	1 (ε)	1 (ε)	2 (0.67)	1 (0.33)	1 (ε)	12	
	Sum	5	3	2	4	2	2	2	3	3	2	28	
	E_j	0.97	0.92	(ε)	0.81	(ε)	(ε)	(ε)	(ε)	0.92	0.92	(ε)	
	d_j	0.03	0.08	0.99	0.19	0.99	0.99	0.99	0.08	0.08	0.99		
	w_j	0.005	0.01	0.18	0.03	0.18	0.18	0.18	0.01	0.01	0.18		

Note. Normalized Data is in Parentheses, E_j : degree of Entropy, d_j : degree of diversification, w_j : degree of Weight ε: 0.000001, & Numbers Represent EE Components.

Table 3
Decision matrix of EE in SST of 11th grade

Components		1	2	3	4	5	6	7	8	9	10	p_{ij}
Resource												
11 th grade (n= 3212)	Chapter One	1 (0.12)	2 (0.66)	0 (0.00)	0 (0.00)	0 (0.00)	1 (ϵ)	0 (0.00)	3 (0.25)	3 (0.37)	1 (ϵ)	11
	Chapter Two	2 (0.25)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
	Chapter Three	5 (0.63)	1 (0.34)	3 (0.75)	6 (0.85)	5 (0.83)	1 (ϵ)	9 (0.90)	9 (0.75)	5 (0.63)	1 (ϵ)	45
	Chapter Four	0 (0.00)	0 (0.00)	1 (0.25)	1 (0.15)	1 (0.17)	0 (0.00)	1 (0.10)	0 (0.00)	0 (0.00)	0 (0.00)	4
	Sum	8	3	4	7	6	2	10	12	8	2	62
	E_j	0.64	0.46	0.40	0.30	0.33	(ϵ)	0.23	0.41	0.47	(ϵ)	
	d_j	0.36	0.54	0.60	0.70	0.67	0.99	0.77	0.59	0.53	0.99	
	w_j	0.05	0.07	0.08	0.10	0.09	0.14	0.11	0.08	0.07	0.14	

Note. Normalized Data is in Parentheses, E_j : degree of Entropy, d_j : degree of diversification, w_j : degree of Weight, ϵ : 0.000001, & Numbers Represent EE Components.

most consideration for EE ($p_{ij}= 36$) was in the third chapter of this book and the highest weight ($w_j= 0.16$) was related to noise pollutants and environmental protection in the Constitution. It can be concluded that

the most neglect towards EE was in these components. EE was not a priority in 12th grade SST and a proportion of curriculum content should be included in these books (see Table 4).

Table 4
Decision matrix of EE in SST of 12th grade

Components		1	2	3	4	5	6	7	8	9	10	p_{ij}
Resource												
12 th grade (n= 3324)	Chapter One	1 (0.20)	2 (0.50)	0 (0.00)	0 (0.00)	0 (0.00)	1 (ϵ)	0 (0.00)	1 (0.14)	1 (0.33)	1 (ϵ)	7
	Chapter Two	1 (0.20)	1 (0.25)	0 (0.00)	1 (0.33)	1 (0.14)	0 (0.00)	1 (0.11)	1 (0.14)	0 (0.00)	0 (0.00)	6
	Chapter Three	3 (0.60)	1 (0.25)	5 (0.83)	3 (0.64)	7 (0.86)	1 (ϵ)	8 (0.89)	5 (0.72)	2 (0.64)	1 (ϵ)	36
	Chapter Four	0 (0.00)	0 (0.00)	1 (0.17)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
	Sum	5	4	6	4	8	2	9	7	3	2	50
	E_j	0.68	0.75	0.33	0.47	0.29	(ϵ)	0.25	0.57	0.47	(ϵ)	
	d_j	0.32	0.25	0.67	0.53	0.71	0.99	0.75	0.43	0.53	0.99	
	w_j	0.05	0.04	0.10	0.08	0.11	0.16	0.12	0.06	0.08	0.16	

Note: Normalized Data is in Parentheses, E_j : degree of Entropy, d_j : degree of diversification, w_j : degree of Weight, ϵ : 0.000001, & Numbers Represent EE Components.

The Fourth Question

Of the sum total of 9070 units identified for SST, only 144 units were allocated to EE, indicating that EE in all SST was not adequately considered. EE in the 10th grade SST was ($p_{ij}= 32$), EE in the 11th grade SST was ($p_{ij}= 62$), and EE in the 12th grade SST was ($p_{ij}= 50$). Therefore, the most considerable EE was for the 11th grade

SST and the highest weight ($w_j= 0.37$) was related to noise pollutants and environmental protection in the Constitution. It can be concluded that the most neglect towards EE was in these components. EE was not a priority in SST and a proportion of curriculum content should be included in these textbooks (see Table 5).

Table 5
Decision matrix of EE components in Senior High School SST

Components		1	2	3	4	5	6	7	8	9	10	p_{ij}
Resource												
Sum (n=9070)	10 th grade	5 (0.28)	3 (0.30)	2 (0.16)	4 (0.26)	2 (0.12)	2 (ϵ)	2 (0.10)	3 (0.14)	3 (0.21)	2 (ϵ)	32
	11 th grade	8 (0.44)	3 (0.30)	4 (0.34)	7 (0.48)	6 (0.38)	2 (ϵ)	10 (0.48)	12 (0.54)	8 (0.58)	2 (ϵ)	62
	12 th grade	5 (0.28)	4 (0.40)	6 (0.50)	4 (0.26)	8 (0.50)	2 (ϵ)	9 (0.42)	7 (0.32)	3 (0.21)	2 (ϵ)	50
	Sum	18	10	12	15	16	6	21	22	14	6	144
	E_j	0.97	0.99	0.91	0.95	0.88	(ϵ)	0.86	0.89	0.88	(ϵ)	
	d_j	0.03	0.01	0.09	0.05	0.12	0.99	0.14	0.11	0.12	0.99	
	w_j	0.01	0.003	0.03	0.02	0.04	0.37	0.05	0.04	0.05	0.37	

Note. Normalized Data is in Parentheses, E_j : degree of Entropy, d_j : degree of diversification, w_j : degree of Weight, ϵ : 0.000001, & Numbers Represent EE Components.

CONCLUSION

The purpose of this study was to identify the role of EE in senior high school SST in Iran. The results show that there is no balanced and comprehensive attention to EE in 10th, 11th, and 12th grade SST. The main findings indicate that in the SST of 10th grade, environmental protection component has the most frequency, while the water pollutants, air pollutants, sound pollutants, industrial pollutants, and environmental protection in the constitution components have the

least frequency; in the SST of 11th grade, environmental pollution and its relation to human life have the most frequency, while sound pollutants and environmental protection in the constitution have the least frequency; in the SST of 12th grade, air pollutants have the most frequency, while sound pollutants and environmental protection in the constitution have the least frequency. By comparing senior high school SST, it is concluded that attention to the environmental education components has been low in SST.

It is recommended that in the short term, in-service training and workshops provide to teachers and in the long term, SST becomes reviewed and revised to include appropriate EE content. Based on the findings, two components of noise pollutants and environmental protection are neglected in the Constitution. For noise pollutants, it can be argued that this phenomenon has not yet reached a crisis level or emerged as a social concern among people and the government. For not paying enough attention to environmental protection in the Constitution, it should be mentioned that the Constitution of the Islamic Republic of Iran (Article 50) explicitly emphasizes environmental protection. Furthermore, in recent years, the Iranian government has invested heavily in coping with drought, restoring Urmia Lake, and confronting the dust particles in the southern regions. In relation to EE, however, more laws are needed in order to protect Iran's national environment. In conclusion, it is suggested that in order to socialize and educate students on respecting the environment, environmental issues and challenges should be included in the content of school textbooks. Therefore, students would be familiar with the knowledge, attitudes, and skills needed for environmental protection.

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