

## Investigation of Health System Assumptions in Curriculum of Fourth Grade Elementary Textbooks Using Shannon Entropy Content analysis

Mohammad Azimi 

Department of Elementary Education, Farhangiyan University, Tehran, Iran

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#### Corresponding Author:

Mohammad Azimi

mohamadazimi19861986@gmail.com

### ABSTRACT

**Introduction:** Health education is an inseparable part of a curriculum for all students. Health education should represent the essential knowledge, attitudes, and skills. So, the present research aimed at investigating health system assumptions in fourth-grade elementary textbooks.

**Method:** This research is applied and descriptive-analytical has been done manually by Shannon's entropy content analysis, which suggests a quantitative approach to data processing. The research has investigated the respondents' viewpoints about the content of fourth-grade elementary textbooks and 12 major components (Physical health, Nutritional health, Environmental health, Natural environment health, Family health, Safety incidents, Physical activity, Mental health, Prevention of high-risk behaviors, Control, and prevention of diseases, Disability, Public health, and school health) and 58 minor components of health education and promotion.

**Results:** In this research, all fourth-grade elementary textbooks have been reviewed. According to Shannon's entropy content analysis results, mental health has the highest frequency with 277 components, and disability has the least frequency with 12 components. Among the 1157 health components in fourth-grade elementary textbooks, there are 81 physical health components, 263 nutritional health components, 57 environmental health components, 33 natural environment health components, 227 family health components, 19 safety incident components, 73 physical activity components, 277 mental health components, 25 component of prevention of high-risk behaviors, 14 components of disease control and prevention, 12 disability components, and 58 components of public health and school health.

**Conclusion:** According to the content analysis, there is no normal distribution between the components of health education and health promotion among the components studied in the content of the fourth-grade books, so that little attention has been paid to health education components in fourth-grade elementary textbooks.

**Keywords:** Health education, Fourth-grade elementary textbooks, Health system assumptions

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## Introduction

A school is an ideal place for health promotion, and it can provide an appropriate environment for education and practice of positive health behaviors (1). Children spend a significant part of their time at school. So, schools are considered as a potential environment influencing the children's health (2). Schools can play a major role in improving health in children to become healthy adults. In general, children and adolescents attend school five days a week; so, they spend much of their time at school. In addition to acquiring academic skills, students can also learn cultural and social skills that strongly affect health behaviors (3).

Health education is an inseparable part of the education curriculum for all students. Health education curriculums should represent the essential knowledge, attitudes, and skills. Health education programs are designed to promote a healthy life and eliminate high-risk health behaviors among students (4) and make them feel more responsible for their health. Health education is the basis of health promotion, including school health promotion and other important components (5). Regarding the Ottawa Charter emphasizing education as a health requisite, WHO has introduced schools as promoters of health. Comprehensive health education programs in schools and parents and societies' participation in health promotion programs have been emphasized as major health promotion components (6, 7).

According to the above statements, health is considered as one of the essential human needs. This concept is considered as physical, mental, and social welfare by WHO, and policymakers have always paid it attention. Fortunately, policymakers of the education system have also paid attention to the importance of health issues. They believe achieving its ultimate goal is to realize healthy life; the education system should not ignore the health dimension. One of the fundamental aspects of education is considered biological and physical aspects that directly focus on health promotion (8).

- In 2002, UNESCO developed a program titled "Teaching and learning for a sustainable future" for

students; one of the four themes of this program curriculum was health education (9).

- Also, principle 29 of constitutional Law has introduced health as a public right. As teachers are responsible for educating the future generation, they and their students should be provided with curriculums, including health promotion considerations (5).

WHO studies on health behaviors in 35 countries (2015) suggest that about 60% of people's health and quality of life depend on their lifestyle and personal behaviors. Borhani (2014) found that the adolescents' health promoting behaviors is not at the same level, and it can be due to their personal characteristics (10). Also, Sahi, Ebrahimi, and Mohammadi reported that 70.9% of students are at a medium level of health-promoting behaviors, and their lowest scores have been obtained in stress management, physical activity, and nutrition components (11). In the current conditions in Iran, we need to promote health components in different groups of the society, including teachers, to have a more healthy society.

A national study performed in 5 provinces to investigate people above 18 years old suggested that health literacy is at a low level in Iran. Moreover, a study performed in 2012 showed a low level of health literacy in Kerman province (7).

So, despite the importance of health education, studies suggest that this issue has not been paid enough attention in Iran; different classes, especially teachers and students, are not provided with health-promoting programs. Although no study has yet investigated health literacy among teachers and teacher training students, some of the findings of health-related studies can be useful in this area. Imani, Rakhshani, and Tabatabaei (2004) found that only one percent of elementary school teachers have adequate information about environmental health and the students' physical and mental health needs.

The findings mentioned above can be considered as a threat to the quality of education of future teachers and students; because the time

students spent at school is more than the time they spent with their parents. According to Eisner (1992), a school is an ideal place for health promotion (12). So, increasing the teachers' health literacy provides a condition in which they will try to promote their own and their students' health. Besides, the health-promoting school program has been applied in Iran since 2010. The successful operation of health-promoting school programs will not be realized without defining health promotion for teachers. Furthermore, a comparative investigation of Iranian students and students from the four countries of Japan, Australia, France, and Turkey showed that obesity, malnutrition, smoking, oral and dental health problems, venereal diseases, and high-risk behaviors are increasing in Iran.

Nekouei Moghadam et al. (2010) reported that the content of health education textbooks had no effect on students' ability and attitudes and had not acquired enough skills (13).

To make change, prevent diseases, and promote human force health that are considered the goals of health system transformation plan, health education should be focused in different classes of society, especially students at younger ages. Since the school system directly affects children and adolescents and an indirect effect on adults, it seems that optimal health education in elementary programs is one of the simple ways to provide health education for the general public. According to the investigation of health education status in elementary school textbooks and content analysis of health information components in middle school textbooks, there should be more attention to different health education dimensions in these books. Moreover, some of the health information components have not been paid enough attention in textbooks (14-15). Therefore, health education and promotion can provide students and teachers with the opportunity of acquiring knowledge, information, and skills that will lead them towards appropriate health behaviors and habits. So, designing patterns and planning for education, improving negative health behaviors, and creating health-promoting behaviors in elementary school

students is unavoidable (16). Hence, this research aimed to investigate the content of fourth-grade elementary school textbooks in terms of the health system's assumptions and check the extent to which these assumptions are observed in educational materials.

## Methods

This qualitative study was performed via content analysis using Shannon Entropy Technique. The unit of analysis is the page (texts, questions, drills, and pictures). Content analysis is done in different stages. Three major stages include the following:

1. Pre-analysis (preparation and organization)
2. Review of the materials (message)
3. Processing of the results (17)

This research is mainly focused on the third stage of content analysis that is processing the collected data of the message. After coding and categorizing the message, the obtained data were analyzed. Nowadays, various techniques have been proposed in this area based on getting the percentage of the categories frequency. These techniques have special mathematical problems that decrease the reliability of their results. This research tried to process the results by a new method that is based on the systems theory. The used method is Shannon's entropy which proposes a new qualitative and quantitative approach to content analysis. This method is a very strong and reliable way of content analysis. In information theory, entropy is an indicator for evaluating uncertainty expressed by a probability distribution (18). Based on this method that is referred to as the compensatory method, the respondents' viewpoints about the content (fourth-grade elementary school textbooks) and 12 major components and 8 minor components of health education and promotion were investigated. The validity of health education and promotion was evaluated based on health experts' viewpoints and the curriculum. To ensure accuracy of the analysis results, the upstream documents were analyzed by the researchers and six health education experts. For the same perception of the content analysis form, the

researchers' viewpoints about health education, its components, and units of analysis became coordinated.

Step 1: Frequency matrices of the frequency table should become normalized by the following relation:

$$(1)- P_{ij} = \frac{F_{ij}}{\sum_{i=1}^m F_{ij}} \quad (i=1, 2, 3, \dots, m, j=1, 2, \dots, n)$$

F=frequency of the component

P=normalized frequency matrix

Step 2: Information load of every category is calculated and included in the related column. It is done by the following relation:

$$(2)- E_j = -k \sum_{i=1}^m [p_{ij} \ln p_{ij}] \quad (i=1, 2, 3, \dots, m, j=1, 2, \dots, n) \quad k = \frac{1}{\ln M}$$

Step 3: Coefficient of importance is calculated by the information load of indicators. The indicator with a higher information load will have a higher degree of importance ( $W_j$ ).

$$(3)- W_j = \frac{E_j}{\sum_{j=1}^m E_j}$$

Due to the occurrence of error and infinite answers in mathematical calculations, to calculate JE, JiP values equal to zero have been replaced by a little number, i.e., 0.00001. JW is an indicator specifying the importance coefficient of each category of a message regarding the respondents. On the other hand, the message categories have also been ranked based on the W vector (19).

This research tries to investigate health education and promotion components in fourth-grade elementary school textbooks. According to Hiroshi (2012), health-related habits should be acquired in the early stages of life to prevent adulthood's physical and mental diseases. For this purpose, related rules should be developed, and

necessary educations should be provided for people. In this research, we have investigated 12 components of health education and promotion. According to previous studies, each of these components includes several subcomponents presented in the following table. The components and indicators studied in this research have been extracted from studies performed by Helm Seresht and Delpisheh (2009), Shah Hosseini (2016), Shadarzi (2015), Eskandari (2015), Jamison (2001), Ackerman (2004), Lason (2003)(20). However, no study has independently investigated health education and promotion in fourth-grade elementary textbooks yet. The research components and indicators were derived from previous relevant studies, doctors' and health experts' viewpoints, and books. After determining the evaluation indicators, health education, and promotion components, the data were collected and analyzed by Shannon's entropy. In this way, fourth-grade textbooks have been investigated to the extent that health education and promotion components have been addressed.

## Results

The findings include qualitative and quantitative analysis of the components found in all the fourth-grade elementary textbooks based on the health system components. First, the frequencies were obtained for each component, and they were converted to normalized data according to the first step of Shannon's entropy method. Then, according to Shannon's entropy's second step, uncertainties of the data are included in the tables. After that, according to Shannon's entropy's fourth step, coefficients of importance are determined for the data. In this way, the component with the highest importance is specified.

**Table 1.** Frequency distribution of health system assumptions in fourth-grade elementary textbooks

Scale	Subscale	Components						Frequency Total frequency of subscale	Frequency Total frequency of scales	
		Quran	Persian language	Mathematics	Science	Theology	Social sciences			
Physical health	Body systems	3	38	3	20	0	1	65	81	
	Lifecycle	8	0	0	1	6	0	15		
	Body care	0	1	0	0	0	0	1		
Nutritional health	Familiarity of foods	6	16	15	3	0	2	42	263	
	Nutritional needs	2	0	4	10	0	5	21		
	Vegetation	2	13	4	36	0	25	80		
	Fauna	0	14	0	40	6	15	75		
	Energy	0	15	0	0	6	8	29		
	Growth control	0	0	1	1	0	2	4		
	Nutrition pattern	3	0	0	3	0	2	8		
Environmental health	Food health	1	0	0	0	0	3	4	75	
	Water health	1	0	8	18	0	18	45		
	Air health	0	1	2	6	0	10	19		
Natural environment health	Soil health	1	0	1	0	0	9	11	33	
	Noise pollution	0	0	0	3	5	6	14		
	Waste disposal	0	5	0	0	0	11	16		
	Countering arthropods and rodents	0	1	0	0	0	1	2		
	Wastewater and healthy disposal	0	0	0	0	0	1	1		
Family health	Population	0	0	6	15	0	162	183	227	
	Adolescents' health	0	0	1	0	0	1	2		
	Caring for children	4	0	2	2	0	2	10		
	Pregnancy cares	0	0	0	1	2	0	3		
	Family relations care	12	0	0	1	0	16	29		
Safety incidents	Prevention of home incidents	0	0	0	0	0	0	0	19	
	Prevention of school incidents	0	0	0	0	0	0	0		
	Prevention of social incidents	1	0	0	4	2	3	10		
	Countering natural disasters	0	0	1	4	0	4	9		
	First aid and workplace health	0	0	0	0	0	0	0		
	Importance of physical activity and fitness	0	0	0	4	0	3	7		
	Exercise safety and the relevant rules	0	0	38	0	0	7	45		
Physical activity										

Components		Quran	Persian language	Mathematics	Science	Theology	Social sciences	Frequency	
Scale	Subscale							Total frequency of subscales	Total frequency of scales
Mental health	Importance of game and its different types	0	0	0	2	1	10	13	
	Motor skills	0	0	0	0	2	3	5	
	Corrective exercise	0	0	0	0	0	0	0	
	Doping drugs	0	0	0	0	0	0	0	
	Sport health and nutrition	0	2	0	0	0	1	3	
	Self-awareness and self-esteem	13	0	2	3	17	1	36	
	Emotions	2	0	1	41	57	6	107	
	Decision making	13	0	0	4	0	2	19	
	Communication	2	0	1	4	53	11	71	277
	Critical thinking	0	2	2	7	0	17	28	
Prevention of high risk behaviors	Peer relationship	2	0	0	3	9	2	16	
	Unhealthy habits	2	0	1	0	1	0	4	
	Addition	0	0	0	0	0	0	0	
	Addictive drug types	0	0	0	0	0	0	0	
	The effects of smoking on the body	0	0	0	0	0	0	0	25
Control and prevention of diseases	Violation	1	0	0	11	4	5	21	
	AIDS	0	0	0	0	0	0	0	
	Health and disease	0	0	1	6	1	2	10	
Disability	Patient care	0	0	0	0	0	4	4	14
	Familiarity with diseases	0	0	0	0	0	0	0	
	Importance of disability	0	0	0	1	0	0	1	
	Prevention and helping the disabled	0	0	0	1	0	0	1	
Public health and school health	Different types of disability	1	0	0	8	0	1	10	12
	School and neighborhood activities	1	0	2	8	0	25	36	
	Social factors and public health	4	3	0	0	2	2	11	58
	Individual health	1	4	1	1	0	0	7	
Total	Nutritional health	0	2	2	0	0	0	4	
		86	117	99	272	174	409	1157	1157

According to Table 1, among the components studied in 6 fourth-grade elementary school textbooks, the highest frequency (277) has been reported for mental health, and the lowest frequency (12) has been reported for disability. Among the 1157 health components in fourth-grade elementary textbooks, there are 81 physical health components, 263 nutritional health components, 57

environmental health components, 33 natural environment health components, 227 family health components, 19 safety incident components, 73 physical activity components, 277 mental health components, 25 component of prevention of high-risk behaviors, 14 components of disease control and prevention, 12 disability components, and 58 components of public health and school health.

**Table 2.** The coefficient of importance and weight of the index of Health System Assumptions in Curriculum of Fourth Grade Elementary Textbooks

Scale	Subscale	Components			Textbooks			The values of uncertainty (Ej) and (Wj)		
		Quran	Persian language	Mathematics	Science	Theology	Social sciences	(Ej)	(Wj)	
Physical health	Body systems	0.046	0.585	0.046	0.308	0	0.015	0.572	0.026	
	Lifecycle	0.533	0	0	0.067	0.400	0	0.492	0.023	
	Body care	0	1	0	0	0	0	0	0	
Nutritional health	Familiarity of foods	0.143	0.381	0.357	0.071	0	0.048	0.752	0.035	
	Nutritional needs	0.095	0	0.190	0.476	0	0.238	0.689	0.032	
	Vegetation	0.025	0.162	0.050	0.450	0	0.312	0.703	0.032	
	Fauna	0	0.187	0	0.533	0.080	0.200	0.654	0.030	
	Energy	0	0.517	0	0	0.207	0.276	0.571	0.026	
	Growth control	0	0	0.250	0.250	0	0.500	0.580	0.027	
	Nutrition pattern	0.375	0	0	0.375	0	0.250	0.604	0.028	
Environmental health	Food health	0.250	0	0	0	0	0.750	0.314	0.014	
	Water health	0.022	0	0.178	0.400	0	0.400	0.628	0.029	
	Air health	0	0.053	0.105	0.316	0	0.526	0.610	0.028	
Natural environment health	Soil health	0.091	0	0.091	0	0	0.818	0.335	0.015	
	Noise pollution	0	0	0	0.214	0.357	0.429	0.592	0.027	
	Waste disposal	0	0.312	0	0	0	0.687	0.347	0.016	
	Counteracting arthropods and rodents	0	0.500	0	0	0	0.500	0.387	0.018	
Family health	Wastewater and healthy disposal	0	0	0	0	0	1	0	0	
	Population	0	0	0.033	0.082	0	0.885	0.237	0.011	
	Adolescents' health	0	0	0.500	0	0	0.500	0.387	0.018	
	Caring for children	0.400	0	0.200	0.200	0	0.200	0.744	0.034	
	Pregnancy cares	0	0	0	0.333	0.667	0	0.355	0.016	
Safety incidents	Family relations care	0.414	0	0	0.034	0	0.552	0.452	0.021	
	Prevention of home incidents	0	0	0	0	0	0	0	0	
	Prevention of school incidents	0	0	0	0	0	0	0	0	
	Prevention of social incidents	0.100	0	0	0.400	0.200	0.300	0.714	0.033	
	Counteracting natural disasters	0	0	0.111	0.444	0	0.444	0.539	0.025	
	First aid and workplace health	0	0	0	0	0	0	0	0	

Components		Textbooks					The values of uncertainty (Ej) and (Wj)		
Scale	Subscale	Quran	Persian language	Mathematics	Science	Theology	Social sciences	(Ej)	(Wj)
Physical activity	Importance of physical activity and fitness	0	0	0	0.571	0	0.429	0.381	0.017
	Exercise safety and the relevant rules	0	0	0.844	0	0	0.156	0.241	0.011
	Importance of game and its different types	0	0	0	0.154	0.077	0.769	0.383	0.018
	Motor skills	0	0	0	0	0.400	0.600	0.376	0.017
	Corrective exercise	0	0	0	0	0	0	0	0
	Doping drugs	0	0	0	0	0	0	0	0
Mental health	Sport health and nutrition	0	0.667	0	0	0	0.333	0.355	0.016
	Self-awareness and self-esteem	0.361	0	0.056	0.083	0.472	0.028	0.664	0.030
	Emotions	0.019	0	0.009	0.383	0.533	0.056	0.548	0.025
	Decision making	0.684	0	0	0.211	0	0.105	0.460	0.021
	Communication	0.028	0	0.014	0.056	0.746	0.155	0.463	0.021
	Critical thinking	0	0.071	0.071	0.250	0	0.607	0.573	0.026
Prevention of high risk behaviors	Peer relationship	0.125	0	0	0.187	0.562	0.125	0.646	0.030
	Unhealthy habits	0.500	0	0.250	0	0.250	0	0.580	0.027
	Addition	0	0	0	0	0	0	0	0
	Addictive drug	0	0	0	0	0	0	0	0
	types								
	The effects of smoking on the body	0	0	0	0	0	0	0	0
Control and prevention of diseases	Violation	0.048	0	0	0.524	0.190	0.238	0.637	0.029
	AIDS	0	0	0	0	0	0	0	0
	Health and disease	0	0	0.100	0.600	0.100	0.200	0.608	0.028
	Patient care	0	0	0	0	0	1	0	0
	Familiarity with diseases	0	0	0	0	0	0	0	0
Disability	Importance of disability	0	0	0	1	0	0	0	0
	Prevention and helping the disabled	0	0	0	1	0	0	0	0
	Different types of disability	0.100	0	0	0.800	0	0.100	0.357	0.016
Public health and school health	School and neighborhood activities	0.028	0	0.056	0.222	0	0.694	0.473	0.022
	Social factors and public health	0.364	0.273	0	0	0.182	0.182	0.749	0.034
	Individual health	0.143	0.571	0.143	0.143	0	0	0.644	0.030
	Nutritional health	0	0.500	0.500	0	0	0	0.387	0.018

According to Table 2, the highest coefficient of importance (0.22) has been reported for utritional health components (0.014+0.028+0.027+0.026+0.030+ 0.032+0.032+0.035+0.0), and the lowest coefficient of importance (0.016) has been reported for disability.

## Discussion

According to the content analysis of fourth-grade elementary school textbooks, the frequency of 12 major components and 57 minor components was obtained as 2415. Based on the resulted frequencies, health system components do not have a normal distribution; because some of the components have been paid more attention than others. Also, the frequencies obtained from both programs' texts suggest that the components do not have a normal distribution. Among all the components investigated in 6 textbooks of fourth-grade elementary school, the highest frequency (645) was reported for mental health, and the lowest frequency (7) was reported for disability. According to the results of content analysis of the studied textbooks, it can be concluded that unfortunately, health education and promotion has been paid little attention; whereas based on the documents (fundamental transformation document of education, 3, 4, and 5 constitutional programs, health-related instructions, and health system transformation plan), health issue, its importance, and healthcare have been explicitly introduced as important and infrastructure dimensions of different aspects of development. The curriculums were expected to focus on health system health components and make people familiar with health education and promotion, health problems, and healthcare solutions. Experts believe that the designing and execution of health development programs depends on education. In other words, designing and executing health development programs mainly requires normal and informal educations (21).

Furthermore, five resources have been mentioned for the development of human needs; these five resources include education, nutrition and health, environment, employment, and economic and political freedom. Among the mentioned factors,

education is considered the most important and basic human force development resource in all countries (16). Accordingly, the relevant studies have investigated education and health from different aspects, and they have emphasized the necessity of health education in different ways. Also, some studies have investigated different components of health in educational content. Several schools have provided health education as a course for students (22). Izadi et al. studied elementary program books in terms of health education components, and they concluded that exercise and physical activity had been paid more attention among the studied components.

In contrast, health education components have not paid balanced attention in elementary program books (23). Salehi et al. studied elementary program textbooks in terms of global education components, and they concluded that the studied components have not been paid the same attention (24). Analysis of health-promoting behaviors among students is one of the fundamental issues in every country's education system, and recognition of the factors related to the elementary students' health-associated behaviors is considered one of the research priorities. This research has investigated health education's role as one of the determinant factors related to the elementary program's health-promoting behaviors. According to the findings of the present study, increased focus on education of health components leads to improvement of health-promoting behaviors. This finding is consistent with the results of the study performed by Molaei et al. (25). The found relationship suggests the necessity of education of health components and employing specialized health coaches in schools. Meanwhile, a significant direct relationship was found between the interest in health issues and health-promoting behaviors. It can be stated that people interested in health-related issues are more likely to pay attention to their health and seek health information. As the components of disability and prevention of high-risk behaviors respectively got the lowest scores, it is necessary to pay more attention to these two issues to increase the students' awareness and change their

attitudes before their health behaviors becomes internalized.

In this study, due to the wide scope of the research, limiting the studies to the fourth grade does not allow generalization to textbooks in other courses, and less attention has been paid to the components of health education and health promotion. Therefore, for future studies, it is suggested that in designing and compiling textbooks, using the opinions of experts and planners of the health system, attention be paid to this important issue and other educational levels in the elementary school.

### Conclusion

Therefore, it should be noted that elementary program textbooks can form childhood attitudes and habits and play a major role in adulthood decisions. Furthermore, elementary program textbooks should be evaluated to be practical and useful for education; so that they can respond to

emotional and social needs, satisfy the individuals' curiosity, provide the ability to get aware of oneself and the surrounding world, bring some values for the students, and create peace and hope in them.

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### Author contribution

All stages of article writing and analysis have been done by M.A

### Conflict of Interest

The authors declare no conflict of interest.

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