ISSN (print): 2588-5731 E-ISSN: 3060-6535

Validation of a Behavior-Based Safety Model in Elementary Schools with a Passive Defense Approach

Maryam Zare[1], Reza Zarei[2], Mozhgan Amirianzadeh[3], Abadallah Ahmadi[4]*

Received Date: 09/07/2023 *Accepted Date: 09/11/2023*

Pp: 110-131

Abstract

Introduction: This study was aimed at validating a behavior-based safety model in elementary schools with a Passive Defense approach.

Methodology: The present research used a descriptive-survey methodology, employing cluster random sampling. A sample of 62 principals and 239 teachers was selected from a population of 712 individuals – 637 teachers and 75 principals. Data were collected using a researcher-made questionnaire, developed following qualitative findings and verified for reliability with a reliability coefficient above 0.7, determined through Cronbach's alpha using SPSS software for both the behavior-based safety model and its components. The questionnaire's validity was assessed via exploratory factor analysis, using principal component extraction and Varimax rotation. For assessing the reliability of the quantitative section, test-retest, Cronbach's alpha, and split-half methods were employed. To calculate test-retest reliability, the scale was administered to 30 normal participants with a two-week interval, and the test-retest reliability coefficients were computed from both administrations.

Findings: In all cases, the minimum factor load exceeded 0.4, and the bootstrapping output in the model significance test indicated that the significant values for all paths were greater than 1.96. This finding confirms that the observed variables effectively measured the latent variables. Reliability values for all variables were above 0.7, and divergent validity was supported based on the Fornell-Larcker matrix, as each construct's correlation with itself was higher than its correlation with other constructs. Thus, all examined indices were validated, indicating that the designed model was acceptably reliable.

Conclusion: Focusing specifically on schools – particularly elementary schools due to the students' unique age and physical characteristics and their relatively large population compared to other educational levels – can be a key objective for Passive Defense efforts aimed at enhancing deterrence, reducing vulnerability, and mitigating harm. The selected indicators and variables in the current research are crucial for identifying and evaluating the study area from a Passive Defense perspective, and they could significantly contribute to the prevention and control of damages and losses.

Key Words: Validation, Behavior-Based Safety, Passive Defense

[1]- Doctoral student of educational management, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran..

[2]- Assistant Professor, Department of Educational Sciences, Marvdasht Branch, Islamic Azad University Marvdasht, Iran.* Corresponding Author Zaremaryam2017@gmail.com

3- Assistant Professor, Department of Educational Sciences Marvdasht Branch, Islamic Azad University, Marvdasht, Iran.

4- Assistant Professor, Department of Educational Sciences, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran

Introduction

As we observe, incidents inevitably occur at various times and places, often resulting in fatalities, serious or minor injuries, property damage, social impact, and, in some cases, reputational harm to organizations. Schools, as fundamental institutions of education, encompass a large sector of society and are essential for the future of our nation, Iran, with a student population exceeding 12 million. National statistics indicate that, regrettably, numerous students have become victims of unfortunate incidents within the educational system in recent decades. Given the role of educational systems in developing society's human capital, protecting students – who are a national asset and leaders of future development – and prioritizing their safety and well-being as a fundamental human right is of paramount importance. To this end, a behavior-based safety (BBS) model with a Passive Defense approach offers a framework promoting the prevention and reduction of incidents by eliminating or controlling hazards. This approach is essential because the loss of human resources and irreversible impact on human assets is a significant burden for any organization.

BBS is described as "the application of behavior modification science to real-world safety issues" or, alternatively, "a process fostering safety collaboration between management and employees, continuously focusing people's attention and actions on their daily safety behaviors as well as the behaviors of others. It employs a research-backed intervention strategy to enhance the actions that people undertake" (Cooper, 2009). BBS targets identifying and rectifying behaviors in the environment that influence the occurrence of incidents, taking into account the organizational and social frameworks underlying these behaviors (DeJoy, 2005). The concept of BBS is grounded in the belief that individuals, equipped with better safety knowledge and awareness, develop enhanced safety skills and reduce unsafe behaviors. This approach generally includes implementing educational programs, providing continuous feedback, fostering a safety culture, and creating safer working conditions.

Following Heinrich's investigation in 1998 and the introduction of the Domino Model, the notion emerged that human factors are the primary cause of incidents. Heinrich's research concluded that 88% of incidents stemmed from unsafe actions by individuals. Since then, efforts to improve industrial safety and reduce accidents have been based on two perspectives: the hardware-based approach (technical protections and improvement of the physical workshops) and the software-based approach (training, guidelines, policies, and planning for incident reduction). Despite these efforts, the critical role of human performance in causing significant and sometimes irreversible incident outcomes remained. This realization led safety experts to adopt a behavior-focused approach that considers altering human behavior as the main factor in preventing incidents. Currently, safety culture and its counterparts – safety climate, behavioral safety, and behavior-based safety – are recognized as a distinct approach in safety management. Experts hope to reduce incidents by following this approach (Arqami et al., 2008). However, human errors are

inevitable and labeling individuals as the sole cause of accidents has limitations unless the incident context is well understood. Unfortunately, most studies in this area have concentrated on the outcomes, scope, and costs of safety issues, with limited focus on the causes and reasons behind unsafe behaviors. Although some studies examine factors influencing errors, limited research has delved into the interaction between individual, organizational, and social factors contributing to accidents (Khosravi et al., 2014).

In this regard, Azimi et al. (2023) conducted a study aimed at identifying psychological indicators of safe schools. Findings identified seven key elements for safe schools, including planning and training for crisis and emergency situations, balancing physical and psychological safety, fostering intraand inter-organizational collaboration, providing adequate psychological services, improving access to school-based mental health support, implementing prevention services and early interventions, and empowering teachers and school staff. Ultimately, a model of psychological safety indicators for schools was developed. These identified indicators offer a framework for assessing psychological safety in schools, which can then be evaluated through expert workshops and consultations to determine the level of achievement of these indicators in schools.

Goudarzi (2022), in a paper titled Hazard-Prone Schools, argues that schools are especially susceptible to accidents and incidents due to the significant amount of time children spend there. Such incidents can range from minor to life-threatening, and the capacity of schools to respond varies widely. Preparedness can differ from having an on-site health instructor to simply possessing a first-aid kit. Some schools refer even the smallest incidents to local hospitals or health centers, whereas others manage most incidents internally. Schools can reduce preventable accidents through safety education and by ensuring a safe environment. Besides, teachers should be trained in first aid, and schools should ensure necessary resources are available. Currently, however, most schools lack these types of training, unless some national organizations, such as the emergency services, offer training for schools where teachers express interest in learning first aid for crises.

In a related research titled Presenting a Safe School Model for Education in Iran, Soleymanpour et al. (2021) highlight that a safe school model comprises central psychological-physical components (such as psychological security, physical security, behavioral security, and social security) and educational-curricular components (such as physical security, welfare security, and educational security). These components are influential in fostering a sense of safety among students, including providing psychological security within the school environment.

In another study, Al-Sanea Al-Zaydi et al. (2020), in The Prevalence of School-Related Injuries among Students in A'Dakhiliyah Governorate, report that childhood injuries are a major cause of death, although school-related injuries are not prevalent. They suggest that improving school infrastructure, securing the buildings, and providing age-appropriate furnishings could prevent such injuries.

Mayer et al. (2015), in Preventing School Violence and Promoting School Safety, argue that school safety is essential for children and youth to learn and experience positive developmental pathways. Their findings are categorized into five areas: (a) conceptual foundations, (b) the role of race and ethnicity in school safety, (c) education and roles of school resource officers, (d) school discipline and atmosphere, and (e) bullying and peer victimization.

Among the overarching goals of Passive Defense are reducing vulnerability, minimizing damage to infrastructure, protecting human resources, and safeguarding the nation's significant assets (Strategic Document of the Passive Defense of the Islamic Republic of Iran, 2006).

Iran's geographical and political positioning has historically exposed it to both natural hazards (earthquakes, floods) and human-made threats (war), leading to substantial human and financial losses. Unfortunately, despite the experience of an eight-year war and valuable lessons learned from natural disasters, urban planning and architecture in Iran have not fully prioritized safety and security. Construction practices often continue to increase the vulnerability of physical environments to various crises (Zargari & Haji Ebrahim, 2007). Numerous natural and human-made disasters have affected Iranian educational centers in recent years, including the fire at Shahid Beheshti University laboratories, the 2005 library fire at Tehran University's Faculty of Law, and the complete destruction of the Payame Noor and Islamic Azad University buildings in the 2003 Bam earthquake. These events resulted in not only substantial human and financial losses but also the loss of invaluable resources, including rare books, precious archives, unique research documents, sensitive equipment, and student theses, causing irreparable material and cultural damage to the academic community. Furthermore, the lack of awareness among faculty, students, and staff on how to mitigate risks before and during a crisis has further increased the vulnerability of educational institutions (Falahi, 2010). Based on these observations, to reduce the vulnerability of existing educational infrastructure, Passive Defense training should be a priority within educational programs. This training would help prepare the education system to manage threats, safeguard infrastructure, and protect students and teachers.

Ensuring a safe environment for learning, development, and the mental growth of children is essential. Schools must implement preventive measures to avoid accidents, promote safe behaviors, and protect students from potential hazards. In this regard, validating a behavior-based safety model with a Passive Defense approach remains a promising solution. This BBS model focuses on understanding and modifying human behavior to reduce the likelihood of accidents and injuries. By fostering safe behaviors, schools can create a culture of safety that permeates every aspect of the learning environment. However, successful implementation of such a model requires meticulous planning, effective strategies, and comprehensive validation to ensure its efficacy. The validation process involves collecting data from diverse elementary schools and analyzing the effectiveness of the behavior-based safety model. Using various metrics, including accident rates, incident reports, and surveys of staff and

students, the model's impact on safety outcomes can be assessed. The findings of the present study will serve as evidence to support the effectiveness of the proposed model and aid in the development of evidence-based safety practices in elementary schools. Safety in educational environments is a complex issue, and BBS in educational settings presents additional challenges. In the present study, based on an examination of relevant variables from previous research and the opinions of scientific experts, school administrators, and teachers in Shiraz, and after analyzing qualitative evidence, a behavior-based safety model with a Passive Defense approach was developed for elementary schools. The organizing categories of the model are presented in three main groups:

1. Psychological-Physical Safety: This includes foundational elements of physical and psychological, social, and behavioral security.

2. Managerial-Educational: This category covers foundational aspects such as management, awareness, training and content, and rewards and incentives.

3. Physical Structural Security: This group includes architecture and structural design, facilities and equipment, and proximity and accessibility.

This research uses a quantitative methodology to determine the validity of the aforementioned qualitative model. Therefore, this study is aimed at validating the behavior-based safety model designed for elementary schools with a Passive Defense approach.

Research question

What are the challenges and opportunities of decentralization of high school curriculum with an emphasis on multiculturalism and cultural heritage?

Methodology

This is a descriptive-survey study, as it involves the collection of information, data, and validation of the behavior-based safety model in elementary schools from a Passive Defense perspective.

The present study is a descriptive survey study because it has focused on collecting information, data, and developing and validating a behavior-based safety model in elementary schools with a passive defense approach. The study population included principals and teachers of elementary schools in Shiraz in 1401-1402. In addition, a two-stage cluster random sampling method was used to select the samples. In the first stage, District 2 was randomly selected from among the four districts, and in the second stage, 20 schools were randomly selected from among all elementary schools for girls and boys and were studied.

Table 1- Sample Distribution

Statistical sample		Total population		Girls' elementary school		Girls' elementary school		Region name
Manager	Teacher	Teacher	Teacher	Manager	Teacher	Manager	Teacher	
62	239	75	637	37	285	38	352	District 2

Research Tool

The data collection tool in this study was a researcher-designed questionnaire. Its items were developed based on themes extracted from scientific interviews and reviewed by supervisory faculty. Derived from the main themes and sub-themes identified in the qualitative phase and hypotheses generated from the qualitative work, the questionnaire was structured to address the quantitative research questions. Key items were distilled from the qualitative data, utilizing a Likert scale to allow aggregated responses to each item to represent the concept of each category accurately. To maintain an optimal number of items, the questionnaire was designed to be neither too extensive, which could increase the risk of response errors, nor too brief, which could fail to accurately capture respondents' positions on each category. The items were carefully crafted to avoid response bias, enabling participants to respond freely without interference. The tool underwent stages of exploratory and confirmatory factor analyses, along with various tests for validity and reliability, to ensure it was a reliable and valid measure for assessing the phenomenon under study, based on variables and hypotheses extracted from qualitative data.

Tool Validity

The validity of the questionnaire was assessed through exploratory factor analysis (EFA) using principal component extraction and Varimax rotation. For the quantitative section, reliability was tested using test-retest reliability, Cronbach's alpha, and the split-half method.

Tool Reliability

To assess test-retest reliability, the scale was administered to 30 participants with a two-week interval, and the reliability coefficients from both administrations were calculated. Finally, after reviewing responses to the questionnaire items, expert opinions and suggested modifications ensured the items' validity and appropriateness for measuring the intended goals. Each item's numeric value exceeded the minimum threshold, confirming the questionnaire's content reliability.

The questionnaire's reliability coefficient, calculated using Cronbach's alpha with SPSS software, was reported above 0.7 for both the overall effective teaching model and its components. For data analysis and examining relationships within the conceptual model of the study, Behavior-Based Safety Model Validation in Elementary Schools with a Passive Defense Approach, confirmatory factor analysis (CFA) was performed using SPSS and SMART-PLS software. After receiving necessary approvals, the questionnaires were distributed as a link to the sample group for completion. Demographic findings showed that among the 111 respondents, there were 58 women and 53 men, with age distributions as follows: 54 individuals aged 20-30, 23 aged 30-40, 24 aged 40-50, and 10 aged 50-60. Educational levels included 9 with associate degrees, 73 with bachelor's degrees, 20 with master's degrees, and 9 with doctorates. Regarding organizational roles, 19 were principals and 92 were teachers or instructors. Data analysis involved factor analysis, descriptive

statistics, and the standardized t-test (comparison with desirable and minimum levels).

Research Findings

Validity

CFA was initially applied to evaluate the validity of the designed model, with a focus on assessing model fit indices. To assess the fit of a measurement model, three main criteria are typically used: indicator reliability, convergent validity, and discriminant validity. Indicator reliability was examined using factor loadings, Cronbach's alpha, and composite reliability. Convergent validity was assessed based on the Average Variance Extracted (AVE), as proposed by Fornell and Larcker (1981).

The CFA adhered to the threshold criteria of eigenvalues equal to or greater than 1 and factor loadings equal to or greater than the absolute value of 0.3. Before factor extraction, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were performed as prerequisites for factor analysis.

The KMO sampling adequacy measure resulted in a value of 0.881, indicating that the sample size was suitable for factor analysis. Bartlett's test of sphericity, which verifies the adequacy of data for extracting a specific factor structure, was also significant (ChiSquare=2789, P=0.001), supporting the suitability of the data for factor analysis. Results from exploratory factor analysis (EFA) revealed a three-factor solution that explained 59.32% of the total variance. Specifically, the behavior-based safety model with a Passive Defense approach in elementary schools comprises three meaningful factors with eigenvalues of 1 or greater.

Tables

the "Behavior-Based Safety Model with a Passive Defense Approach in Elementary Schools" comprises 45 questions categorized into three main factors. Table 3 presents the factor loadings of each item for the three factors.

Table 3: Principal Component Analysis with Varimax Rotation for the Three-Factor BBS Model with Passive Defense Approach in Elementary Schools

Row	Summary of Items	Factor 1	Factor 2	Factor 3
١	Physical Health and Hygiene Maintenance and Improvement	٠/٦٨٤		
٢	Food and Nutritional Security	٠/٧٢٩		
٣	Awareness of Disease Prevention Methods	٠/٦٢٦		
٤	Knowledge of Personal Safety and Security (Medical Examinations)	٠/٥٠٤		
٥	Avoidance of Bullying	٠/٥٣٨		
٦	Refraining from Humiliating or Insulting Behavior	٠/٦٣٩		

Row	Summary of Items	Factor 1	Factor 2	Factor 3
۷	Maintaining Confidence and Strengthening Student Camaraderie	۰/٦۱۱		
۸	Avoiding Exam and Homework Pressure	۰/٥۷٤		
۹	Refraining from Mobbing	۰/۸۳۹		
۱۰	Non-Discrimination and Behavioral and Organizational Justice	۰/۷۰٤		
۱۱	Active Listening to Students	۰/٦۱۰		
۱۲	Involvement and Support in Decision-Making	۰/٥۳۸		
۱۳	Recognition of Individual Status in the Group (gender, citizenship, teacher, etc.)	۰/٤۸۳		
۱٤	Respect for Personal Beliefs and Opinions in the Group	۰/٥۲٥		
۱٥	Respect for Norms, Rules, and Freedom of Expression	۰/٥۳۰		
۱٦	Utilizing Expert Resources		۰/٥۸۹	
۱۷	Establishing Organizational Justice		۰/٦۹۹	
۱۸	Management’s Commitment to Safety and Passive Defense Goals		۰/۷۳۸	
۱۹	Using an Appropriate Management Approach for Reporting, Analyzing, and Preventing Incidents		۰/٤۷۹	
۲۰	Risk Awareness, Risk Perception, and Defense Strengthening		۰/٥۱۱	
۲۱	Conducting Related Drills with Relevant Organizations and Institutions		۰/٦۳۹	
۲۲	Showing Safety-Related Films and Slides in Schools; Promoting Knowledge through Targeted Games and Study Culture to Strengthen Safety and Threat Countermeasures		۰/۷٦۹	
۲۳	Self-Care in Safety, Hazard Prevention, Stress Management, and Resilience		۰/٥۹۱	
۲٤	Promoting Security Values (e.g., Responsibility, Respect for Others, Problem Solving in Crisis, Responsible Citizenship, Ability to Refuse Unreasonable Requests)		۰/۸۸۳	

Row	Summary of Items	Factor 1	Factor 2	Factor 3
۲۵	Teaching Safe Use of Websites, Social Media, and Mobile Phones		۰/۷۶۱	
۲۶	First Aid Training and Emergency Response (Safe Points, Sirens, Fire Extinguishers, etc.) for Events Like Fires, Floods, Earthquakes, and Accidents		۰/۵۶۰	
۲۷	Enhancing School Vitality		۰/۷۸۱	
۲۸	Valuing Safe Student Activities as Safety Competencies with Supportive Incentives		۰/۶۰۳	
۲۹	Using Students for Program Management, Soliciting Their Input, etc.		۰/۷۷۱	
۳۰	Related Extracurricular and Developmental Activities (e.g., Exhibitions of Achievements and Ideas, Safety-Related Art Exhibits, Newspapers, and Educational Puzzles, Scientific Excursions)		۰/۵۸۹	
۳۱	Development of Attractive Recreational and Sports Facilities			۰/۷۷۱
۳۲	Observing National Building Safety Regulations			۰/۶۹۰
۳۳	Appeal of the Educational Environment			۰/۶۴۲
۳۴	Having at Least One Basement Floor with Dual-Purpose Use			۰/۶۱۹
۳۵	Quick and Easy Access to Exits and Emergency Exits			۰/۵۰۵
۳۶	Safe and Suitable Educational Equipment (e.g., Computer Monitor Shields)			۰/۶۱۱
۳۷	Fire Alarm and Extinguishing Systems, Warning Signs, and First Aid Kits with Basic Emergency Equipment			۰/۶۷۹
۳۸	Safe Heating and Cooling Facilities			۰/۵۹۸
۳۹	Sanitary Water Storage and Emergency Power Supply			۰/۶۲۳
۴۰	Proper Arrangement of Physical Equipment According to Student Anthropometric Dimensions, Following Ergonomic and Emergency Principles			۰/۷۰۱
۴۱	Distance from Polluted Areas (e.g., Wastewater Treatment Plants, Cold Storages, Garbage Dumps, Factories)			۰/۷۳۲

Row	Summary of Items	Factor 1	Factor 2	Factor 3
٤٢	Respecting Floodways, Rivers, Mountains, etc.			٠/٧٨٠
٤٣	Distance from Noisy and Crowded Areas (e.g., Airports, Highways, Bus Terminals)			٠/٦١١
٤٤	Distance from Urban Infrastructure and Utilities (e.g., Masts, Power Lines, Oil and Gas Pipelines, Fuel Stations)			٠/٥٨٢
٤٥	Parking Access for School and Emergency Services			٠/٥٧١

Based on items such as “To what extent does food and nutritional security play a role in behavior-based safety with a Passive Defense approach in elementary schools?” this factor was named “Psychological-Physical”. It consists of psychological-physical elements that influence behavior-based safety with a Passive Defense approach in elementary schools. This factor includes 15 items with factor loadings ranging from 0.483 to 0.839.

The second factor, including items such as “To what extent do risk awareness, risk perception, and defense strengthening contribute to behavior-based safety with a Passive Defense approach in elementary schools?” addresses other key elements of behavior-based safety with a Passive Defense approach and was named “Managerial-Educational”. This factor comprises 15 items with factor loadings ranging from 0.511 to 0.883.

The third factor, with questions like “To what extent does the development of attractive and enjoyable recreational and sports facilities contribute to behavior-based safety with a Passive Defense approach in elementary schools?” assesses security and protective factors for elementary students, hence named “Physical Structural Security”. This factor includes 15 items with factor loadings ranging from 0.505 to 0.780.

Finally, from this questionnaire, five scores for each factor and an overall score are obtained. The total score for each participant across the entire questionnaire ranges from a minimum of 45 to a maximum of 225. The correlation matrix between the three factors and the total score for the 45-item questionnaire is reported in Table 4.

Table 4: Correlation Matrix of the Three Factors and Total Score

Factors	١	٢	٣
Psychological-Physical	١		
Managerial-Educational	٠/٧٦*	١	

Factors	۱	۲	۳
Physical Structural Security	۰/۵۵*	۰/۸۳*	۱
Total score	۰/۸۷*	۰/٦۹*	۰/۸۳*

As shown in Table 4-4, the correlation between the total score and each of the three factors is significant at the ($p < 0.0001$) level.

To further evaluate the three-factor structure, confirmatory factor analysis (CFA) was conducted. The designed model posits that each factor, identified through its related items, represents a higher-order construct, specifically behavior-based safety with a Passive Defense approach in elementary schools.

Using Amos 23 software, a first-order factor analysis was performed. This analysis assessed the factor loading of each item in relation to its associated factor. The obtained factor loadings indicated the construct validity of the model (Table 5).

Table 5: Factor Loadings of Items in the Three-Factor Structure

Factor	Items		Factor loading
Psychological-Physical	۱.	Physical Health and Hygiene Maintenance and Improvement	۰/۵٦
	۲.	Food and Nutritional Security	۰/٤۰
	۳.	Awareness of Disease Prevention Methods	۰/۲٦
	٤.	Knowledge of Personal Safety and Security (Medical Examinations)	۰/۵۱
	۵.	Avoidance of Bullying	۰/٤۱
	٦.	Refraining from Humiliating or Insulting Behavior	۰/۵۱
	۷.	Maintaining Confidence and Strengthening Student Camaraderie	۰/۵۹
	۸.	Avoiding Exam and Homework Pressure	۰/۵۵
	۹.	Refraining from Mobbing	۰/۵۳
	۱۰.	Non-Discrimination and Behavioral and Organizational Justice	۰/٦٦
	۱۱.	Active Listening to Students	۰/۵۹
	۱۲.	Involvement and Support in Decision-Making	۰/٦٦
	۱۳.	Recognition of Individual Status in the Group (gender, citizenship, teacher, etc.)	۰/٤۳
	۱٤.	Respect for Personal Beliefs and Opinions in the Group	۰/٤۷
	۱۵.	Respect for Norms, Rules, and Freedom of Expression	۰/۵۳
Managerial-Educational	۱٦.	Utilizing Expert Resources	۰/٤۸
	۱۷.	Establishing Organizational Justice	۰/٦۰
	۱۸.	Management’s Commitment to Safety and Passive Defense Goals	۰/٦۲

Factor		Items	Factor loading
	۱۹.	Using an Appropriate Management Approach for Reporting, Analyzing, and Preventing Incidents	۰/٦۷
	۲۰.	Risk Awareness, Risk Perception, and Defense Strengthening	۰/٦٦
	۲۱.	Conducting Related Drills with Relevant Organizations and Institutions	۰/٥۳
	۲۲.	Showing Safety-Related Films and Slides in Schools; Promoting Knowledge through Targeted Games and Study Culture to Strengthen Safety and Threat Countermeasures	۰/٤۹
	۲۳.	Self-Care in Safety, Hazard Prevention, Stress Management, and Resilience	۰/٥۹
	۲٤.	Promoting Security Values (e.g., Responsibility, Respect for Others, Problem Solving in Crisis, Responsible Citizenship, Ability to Refuse Unreasonable Requests)	۰/٦۲
	۲٥.	Teaching Safe Use of Websites, Social Media, and Mobile Phones	۰/٦۷
	۲٦.	First Aid Training and Emergency Response (Safe Points, Sirens, Fire Extinguishers, etc.) for Events Like Fires, Floods, Earthquakes, and Accidents	۰/۷۰
	۲۷.	Enhancing School Vitality	۰/٦۲
	۲۸.	Valuing Safe Student Activities as Safety Competencies with Supportive Incentives	۰/۷۰
	۲۹.	Using Students for Program Management, Soliciting Their Input, etc.	۰/٥۷
	۳۰.	Related Extracurricular and Developmental Activities (e.g., Exhibitions of Achievements and Ideas, Safety-Related Art Exhibits, Newspapers, and Educational Puzzles, Scientific Excursions)	۰/٥۷
Physical Structural Security	۳۱.	Development of Attractive Recreational and Sports Facilities	۰/٦۹
	۳۲.	Observing National Building Safety Regulations	۰/۷۱
	۳۳.	Appeal of the Educational Environment	۰/٤۰
	۳٤.	Having at Least One Basement Floor with Dual-Purpose Use	۰/٥٦
	۳٥.	Quick and Easy Access to Exits and Emergency Exits	۰/٤۰
	۳٦.	Safe and Suitable Educational Equipment (e.g., Computer Monitor Shields)	۰/۲٦
	۳۷.	Fire Alarm and Extinguishing Systems, Warning Signs, and First Aid Kits with Basic Emergency Equipment	۰/٥۱
	۳۸.	Safe Heating and Cooling Facilities	۰/٤۱
	۳۹.	Sanitary Water Storage and Emergency Power Supply	۰/٥۱
	٤۰.	Proper Arrangement of Physical Equipment According to Student Anthropometric Dimensions, Following Ergonomic and Emergency Principles	۰/٥۹
	٤۱.	Distance from Polluted Areas (e.g., Wastewater Treatment Plants, Cold Storages, Garbage Dumps, Factories)	۰/٥٥
	٤۲.	Respecting Floodways, Rivers, Mountains, etc.	۰/٥۳
	٤۳.	Distance from Noisy and Crowded Areas (e.g., Airports, Highways, Bus Terminals)	۰/٦٦

Factor		Items	Factor loading
	٤٤.	Distance from Urban Infrastructure and Utilities (e.g., Masts, Power Lines, Oil and Gas Pipelines, Fuel Stations)	٠/٥٩
	٤٥.	Parking Access for School and Emergency Services	٠/٦٦

Figure Legends

Fig. 1 illustrates the first-order measurement model for BBS with a Passive Defense approach in elementary schools, displayed in standardized estimate mode.

***Figure*1: First-Order Measurement Model for Behavior-Based Safety with a Passive Defense Approach in Elementary Schools (Standardized Estimates)**

The fit indices for the three-factor measurement model were as follows: χ^2=943.73, p=0.0001, df=510, CFI[٥]=0.88, TLI=0.87, RMSEA[٦]=0.061. These values suggest an acceptable model fit, with most indices close to critical thresholds. Additional indices, including the Root Mean Square Residual (RMR[٧]), Goodness of Fit Index (GFI[٨]), Adjusted Goodness of Fit Index (AGFI[٩]), Normed Fit Index (NFI)[١٠], Non-Normed Fit Index (NNFI)[١١], and Incremental Fit Index (IFI)[١٢], were also found to be highly satisfactory,

[٥] Comparative of Fit Index
[٦] Root Mean Square Error of Approximation

[٧] Root Mean Square Residual

[٨] Goodness of Fit Index
[٩] Adjusted Goodness of Fit Index

[١٠] Normed of Fit Index
[١١] Non-Normed of Fit Index
[١٢] Incremental of Fit Index

indicating a good match between the three-factor model and the observed data. The results are detailed in Table 6.

Table 6: Model Fit Indices for the Three-Factor Model

Index	Value
RMSEA	۰/۰۶۱
RMR	۰/۰۴۲
GFI	۰/۹۱
AGFI	۰/۸۷
NFI	۰/۹۵
NNFI	۰/۹۰
IFI	۰/۹۱
CFI	۰/۸۸

Reliability

To determine the reliability of the three-factor behavior-based safety model with a Passive Defense approach in elementary schools, Cronbach's alpha and split-half reliability tests were utilized. For test-retest reliability, the questionnaire was administered to 30 normal participants with a two-week interval, and the reliability coefficients from the two administrations were calculated. The values for these coefficients are presented in Table 7.

Table 7: Test-Retest Reliability Coefficients, Cronbach's Alpha, and Split-Half Reliability

	Test-retest coefficients	Cronbach's alpha coefficients	Split-half coefficients
Psychological-Physical	۰/۸۳	۰/۸۰	۰/۷۹
Managerial-Educational	۰/۷۸	۰/۷۷	۰/۸۷
Physical Structural Security	۰/۷۹	۰/۸۱	۰/۸۰

Table 7 reveals that the test-retest reliability for the first, second, and third factors of the questionnaire is 0.83, 0.78, and 0.79, respectively, indicating satisfactory test-retest reliability. Moreover, Cronbach's alpha coefficients, which reflect the internal consistency of the related items, are favorable, ranging from 0.77 to 0.81. The split-half reliability coefficients, calculated between 0.79 and 0.87, further confirm the tool's reliability.

Question 3: How Do Principals and Teachers View Behavior-Based Safety with a Passive Defense Approach in Elementary Schools?

The percentage distribution of the model factors is presented in Table 8.

Table 8. Percentage Distribution of Model Factors

	Mean	SD	Lower than mean	Equal to Mean	Higher than mean
Psychological-Physical	٤/١١	٠/٤٦	١٣/٧٦	٧١/٣٥	١٤/٨٩
Managerial-Educational	٣/٩٦	٠/٦٥	٢٣/٥٦	٥٩/٣٥	١٧/٠٩
Physical Structural Security	٤/٠٧	٠/٥٨	٢١/٣٩	٦١/٨٠	١٦/٨١

Based on Table 8, the perspectives of principals and teachers on the role of behavior-based safety with a Passive Defense approach in elementary schools are as follows:

a) Psychological-Physical Factor: With a mean of 4.11 and a standard deviation of 0.46, this factor significantly contributes to behavior-based safety with a Passive Defense approach in elementary schools. Within this factor, 13.76% rated it below average, 71.35% rated it at an average level, and 14.89% rated it above average in terms of its role in behavior-based safety.
b) Managerial-Educational Factor: With a mean of 3.96 and a standard deviation of 0.65, this factor also plays an essential role in behavior-based safety with a Passive Defense approach in elementary schools. Within this factor, 23.56% rated it below average, 59.35% rated it at an average level, and 17.09% rated it above average.
c) Physical Structural Security Factor: With a mean of 4.07 and a standard deviation of 0.58, this factor contributes notably to behavior-based safety with a Passive Defense approach in elementary schools. Within this factor, 21.39% rated it below average, 61.80% rated it at an average level, and 16.81% rated it above average.

Figure 2 to 4 present polygonal graphs for each of the three model factors.

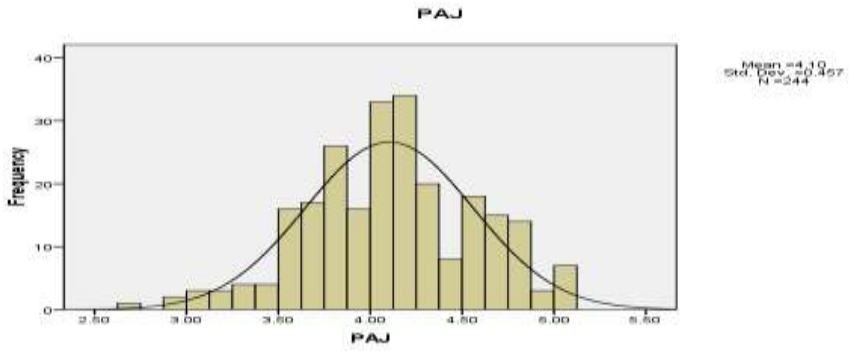

Figure2: Polygonal Graph of the "Psychological-Physical" Factor

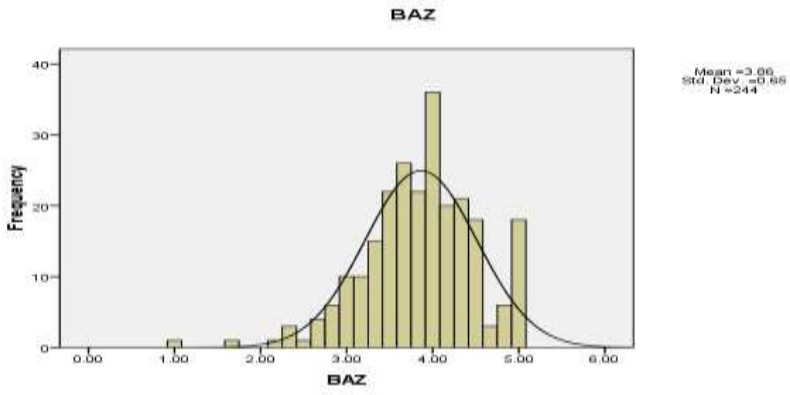

Figure 3: Polygonal Graph of the "Managerial-Educational" Factor

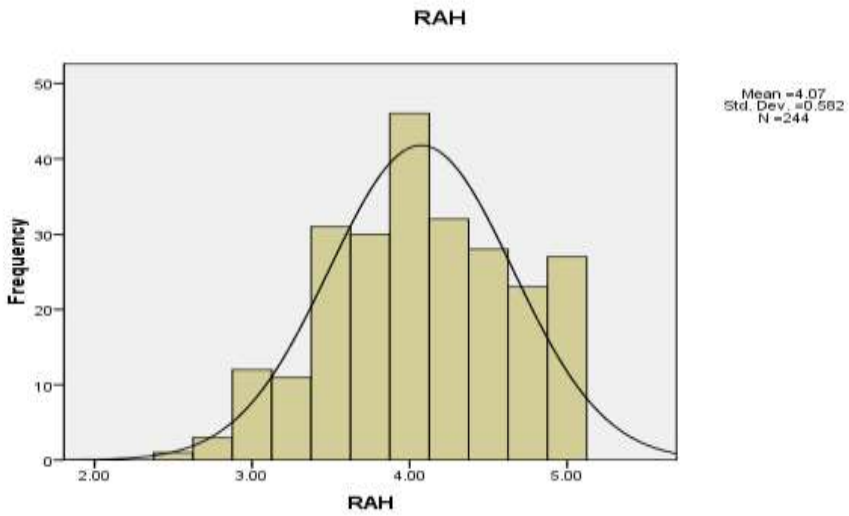

Figure 4: Polygonal Graph of the "Physical Structural Security" Factor

To provide further analysis, the second quartile (Q_2) of the measurement scale was used as a minimum level benchmark, and the third quartile (Q_3) was used as a desirable level for comparison. Results of this comparison are shown in Table 9.

Table 9: Mean and Standard Deviation of the Three Factors Compared to Minimum (Q_2) and Desirable (Q_3) Levels

	Mean	SD	Q_2	T value	Significance level	Q_3	T value	Significance level
Psychological-Physical	٤/١١	٠/٤٦	٤/٠٧	١/١٤١	٠/٢٥٥	٤/٤٢	-١٠/٨٢٢	٠/٠٠٠١
Managerial-Educational	٣/٩٦	٠/٦٥	٣/٩١	١/١٢٠	٠/٢٦٤	٤/٣٣	-١١/٢١٦	٠/٠٠٠١
Physical Structural Security	٤/٠٧	٠/٥٨	٤	١/٩٥١	٠/٠٥٢	٤/٥٠	-١١/٤٦١	٠/٠٠٠١

According to Table 9, the findings indicate that:

a) The mean of the psychological-physical factor (4.11) is insignificantly higher than the minimum level (4.07) but significantly lower than the desired level (4.42).
b) The mean of the managerial-educational factor (3.96) is insignificantly higher than the minimum level (3.91) but significantly lower than the desired level (4.33).
c) The mean for the physical structure security factor (4.07) is insignificantly higher than the minimum level (4.00) but significantly lower than the desired level (4.50).

Discussion and conclusion

schools are among the key social, educational, and training institutions and serve as the foundation of education. They are essential for the proper development of students in religious, ethical, scientific, social, and educational dimensions, as well as for discovering talents and fostering balanced spiritual, mental, and physical growth. To achieve these goals, schools require appropriate educational facilities. Across different educational stages, the country's schools, which serve millions of students distributed throughout urban and rural areas, vary in the quality of educational, health, security, building, and infrastructural services they provide. Given that millions of students interact daily with family life, establishing safe, hygienic, durable schools, and securing current school buildings under effective and modern management contributes to the psychological security of both families and students. Furthermore, in times of threat, schools can serve as safe community

centers beyond their role as educational institutions. Hence, prioritizing Passive Defense strategies is crucial for school safety. Their physical, psychological, and emotional vulnerabilities, along with the condition of school buildings and facilities, heighten the importance of safety. Inadequate educational practices, poor general health and educational services, technical and structural issues, and a lack of or insufficient safety standards, along with managerial weaknesses, can all lead to serious risks during an incident. This research was therefore proposed and conducted with the aim of validating a behavior-based safety model in elementary schools, using a Passive Defense approach.

The first factor, "Psychological-Physical", aligns with studies by Azimi et al. (2023), Hashem Abadi et al. (1401), Goudarzi et al., Ghahveian Miandoab et al. (2022), Alaei et al. (1400), Jabari Zahir Abadi et al. (2021), Basharpour and Bahman Zardi (1398), Amirzadeh & Tabatabaei (2006), Rahimi Pardanjani et al. (2013), Souri (2000), Amirzadeh & Tabatabaei (2006), T.J. Mayer et al. (2015), Al-Zaydi et al. (2020), Xingwei and Hang Yu (2019), and Matthew J. Mayer et al. (2015). Mental and physical health are key factors that influence a person's ability to think critically, learn and study well, live better, develop effective skills, communicate across all areas, and adopt new sports and health technologies. Enhancing children's health and preventing mental and physical illnesses are priorities within health and educational care, as childhood and elementary school experiences may have lifelong impacts that manifest differently with age. The UN Development Programme (UNDP, 2004) considers vulnerability as a range of human-related or physical, environmental, economic, social, and structural factors that heighten exposure to risk. Besides, given the critical role of students, especially at the elementary level, as national human capital, there is a need for sustained efforts to create a healthier learning environment that supports students' physical and mental well-being. Essential steps include maintaining a safe distance from incompatible uses such as industries, ensuring access to uplifting spaces, assessing school wear and tear, evaluating the potential impact radius of sensitive areas near schools, and optimal school location based on relevant standards. The severe adverse effects of disorganized elementary schools, especially due to incompatible urban activities, underscore the need to address and confront these issues (Amanpour et al., 2018). Research by Arslan and Allen (2022) showed that students with strong mental health had stronger connections to their school, better academic performance, more social behaviors, and less bullying and victimization compared to other groups. These findings emphasize the importance of addressing both psychological distress and well-being to understand students' overall adaptability and performance in school environments. Furthermore, the positive impact of addressing mental health and psychological harm early in elementary school is seen later in youth, Overall, combining these positive traits – well-being, a strong sense of school belonging, and psychological adaptability – proved to be more closely associated with school performance and the psychological adjustment of young people than well-being alone. The findings highlight a substantial link between positive psychological characteristics and school-centered and psychological traits in youth.

Thus, promoting students' physical and mental health is a priority in the health system, aligned with policy goal 2, focusing on a comprehensive approach to health and ensuring the well-being of all individuals. Preventing physical and psychological illnesses in elementary school, promoting a dynamic and healthy lifestyle, and fostering open and positive attitudes in raising this generation should be paramount.

The second factor, "Managerial-Educational", aligns with studies by Sadeghi et al. (2021), Nasiri Zarandi & Ali Akbari (2020), Zarei (1399), Pourshaseb & Nazari Nejad (2020), Nasiri Zarandi & Ali Akbari (2019), Rezabeygi Davarani et al. (2019), Marzouqi et al. (2015), Mashhadi Rad et al. (2015), Alizadeh et al. (1387), Janidi et al. (2009), Fam et al. (2010), Omidvari (2012), Sohrabi et al. (2014), Malekian et al. (2013), Wang et al. (2018), Li Hang et al. (2015), Al-Hamoud & Al-Asfour (2006), and Scott Geller (2005). Educational management carries critical importance and a leadership role that directly impacts human resources, as their achievements, whether positive or negative, ultimately affect society as a whole.

Evaluating the performance of teachers and principals to identify their specific educational needs and providing them with guidance, support, and training is essential for fostering development aligned with the actual needs of students and schools. Recently, the evaluation of school principals has gained significant attention for hiring processes, ongoing improvement, and research purposes, focusing on key competencies, essential skills, and the educational outcomes of students (OECD, 2013; CDHCU, 2018).

Based on previous studies and findings from the present research, essential skills required for principals can be categorized into core human and cognitive skills, attitudinal, scientific-educational expertise, creativity, analytical abilities, sound judgment, fairness, resilience under pressure, regular study, up-to-date knowledge and behavior, technological, technical, economic, contingency, health-related, and various managerial and functional competencies. A principal must be capable of developing these abilities and applying them across all relevant domains to validate a behavior-based safety model in elementary schools, ensuring that these competencies reflect in their performance and responsibilities. Thus, a principal's capacity to effectively use knowledge, apply appropriate training and personal experience, and take decisive action in dynamic situations is critical.

The third factor, "Physical Structure Security", aligns with research by Ataei Karizi & Nouhi Bezanjani (2020), Soleymanpour Omran et al. (2021), Sadeghi et al. (2021), Goudarzi (2022), Hashem Abadi et al. (2022), Beygi Davarani et al. (2019), Sadeghi Yarandi et al. (2019), Parvizian et al. (2018), Meshkini et al. (2017), Iranmehr et al. (2016), Marzouqi et al. (2015), Mashhadi et al. (2015), Sohrabi et al. (2014), Khosravi et al. (2013), Malekian et al. (2013), Omidvari (2012), Farsi et al. (2010), Souri (2000), Xingwei and Hang Yu (2019), Wang et al. (2018), Li Hang et al. (2015), Rafiq M. Chaudhry (2013), and Scott Geller (2005). Ensuring a secure educational environment for children, especially in multi-hazard-prone areas, is a major responsibility for policymakers, recognized through various global initiatives and resolutions.

Policymakers must be informed about the safety conditions of educational facilities to design and implement effective school safety improvement programs. In this context, the VISUS multi-hazard methodology was developed to support policymakers in their planning efforts (Grimaz & Malisan, 2020). Nouri Fard & Farzian (2008) concluded that achieving a structure with optimal spatial quality and resilience against earthquakes is possible only through close collaboration between structural and architectural teams from the early design stages through to detailed execution.

In their 2022 study, Javidan and Marouf Nejad, aiming at assessing the effectiveness and prioritize safety indicators for elementary schools in the western area of Bandar Imam Khomeini (RA) with an emphasis on Passive Defense, identified and selected five main indicators – architecture and design, structure, facilities, proximity and accessibility, and equipment – along with 42 sub-indicators. After collecting data from the study area, the evaluation results indicated that these selected indicators are critical for identifying and ranking school buildings within the study area from a Passive Defense perspective. They can play a substantial role in preventing and controlling damages and injuries. In this regard, the research by Razmi and Gholami (2020), which explored architectural design principles for schools from a Passive Defense standpoint, aligns with the current study in terms of the evaluated indicators and underscores the importance of these criteria for designing educational buildings. Similarly, Amanpour et al. (2018), in their study on assessing the vulnerability of educational centers from a Passive Defense perspective in Ahvaz's elementary schools, evaluated the vulnerability levels of these schools in various urban districts. However, the indicators used in their study and the model applied for school ranking differ significantly from the current research. Therefore, planning, designing, and implementing safety indicators are essential responsibilities for officials, designers, and architects. In this context, Passive Defense is the most critical approach, ensuring peace of mind, the safety of students, and the protection of infrastructure. Passive Defense encompasses measures enabling defense with minimal resources through reducing or eliminating vulnerabilities, controlling attack consequences, and enhancing resilience to sudden attacks without weaponry or direct conflict. From ethical, humanitarian, and political perspectives, Passive Defense is a peace-oriented concept, too. The most affordable and cost-effective way to counter adversaries is through Passive Defense and preventive security actions to avoid significant damage to critical and sensitive sites. Since prevention is always better than cure, Passive Defense typically begins in peacetime and continues as long as necessary (Razmi & Gholami, 2020).

Conclusion

With the approval of the Fundamental Transformation Document for Education and 23 years since the implementation of the previous school regulations, it has become essential to revise the current operational guidelines for schools. A comprehensive and complete set of regulations is needed to manage schools optimally and effectively, in alignment with higher-level policy documents. This revision should address evolving environmental changes,

current and future needs of students and society, and allow for increased decision-making autonomy within schools. It also seeks to encourage greater involvement from stakeholders, especially families, utilizing "internal and external school resources" to create a more participatory environment. Special attention to schools, particularly elementary schools, is warranted due to the unique physical and developmental characteristics of younger students and the larger student population at this level compared to other educational stages. Focusing on Passive Defense in elementary schools is an effective strategy for enhancing deterrence, reducing risk, and mitigating potential harm. The evaluation results in this study demonstrate that the selected indicators/variables are highly effective in identifying and assessing schools in the study area from a Passive Defense perspective. These factors can play a significant role in damage prevention and control. Unlike previous studies, which paid limited attention to some of these indicators, this research provides a more in-depth analysis of each one. Moreover, promoting a culture of self-help and safety awareness can further contribute to the achievement of Passive Defense safety goals. Individuals experiencing fewer health issues, suffer less damage in incidents, and avoid injuries or fatalities often benefit from the presence of effective school leaders who are well-trained and capable. Schools, particularly at the elementary level, are among the most influential educational institutions, emphasizing the importance of both securing school facilities and familiarizing students with safety practices. This study provided various methods and components for enhancing psychological-physical, managerial-educational, and physical structure safety explained in detail. Consequently, school safety measures are now accessible to those responsible for implementing them, and the approach to safety must strictly adhere to established standards and principles. Adhering to these standards is highly effective in reducing accidents and the resulting injuries. Overall, this study's evaluation results underscore the importance of these indicators in assessing and identifying schools from a Passive Defense standpoint. These indicators may play a substantial role in the prevention and control of damage. Furthermore, compared to previous studies, rarely addressing all these core and subcomponents comprehensively, the present research offers a complete and in-depth view of school safety from multiple perspectives.

References

Arqami, Sh. et al. (2008). Iran Petrochemical Conference, Vol. 1, Summer 2008.

Arslan, G., & Allen, K. A. (2022). Complete mental health in elementary school children: Understanding youth school functioning and adjustment. Current Psychology, 41(3), 1174-1183. https://doi.org/10.1007/s12144-020-00628-0

Amanpour, S.; Mohammadi Dehcheshmeh, M.; Parvizian, A. (2018). Assessment of Educational Centers' Vulnerability from a Passive Defense

Perspective (Case Study: Elementary Schools in Ahvaz Metropolis), Geography and Environmental Studies Quarterly, 7(27): 43-60.

Chamber of Deputies (Cámara de Diputados). (2018b). General Law of the Professional Teaching Service (promulgated in 2013) [Ley General del Servicio Profesional Docente]. Mexico: Chamber of Deputies. Retrieved from: https://goo.gl/bvDY6r Contreras, T. (2016). Ped

Cooper, MD (2009). Behavioral Safety: A Framework for Success. BSMS Franklin, IN

DeJoy D.M., (2005). Behavior changes versus culture change: Divergent approaches to managing workplace safety. Safety Science, 43, 105-129.

Falahi, A. (2010). Cost-Effective Earthquake Risk Reduction for Higher Education Centers: A Case Study of Shahid Beheshti University's Faculty of Architecture and Urban Planning, Armanshahr, Issue 5, Autumn-Winter 2010: 47-64.

Goudarzi, Azam (2022). Teacher Growth Quarterly, Vol. 41, Issue 2, November 2022.

Grimaz, S., & Malisan, P. (2020). Multi-hazard visual inspection for defining safety upgrading strategies of learning facilities at territorial level: VISUS methodology. International journal of disaster risk reduction, 44, 101435. https://doi.org/10.1016/j.ijdrr.2019.101435

Javidan, M., & Marouf Nejad, A. (2023). Assessment of the Importance and Ranking of Safety Indicators for Public Elementary Schools from a Passive Defense Perspective in Bandar Imam Khomeini, Geography and Planning (forthcoming). (http://doi.org/10.22034/GP.2023.54749.3079).

Khosravi, Y. (2014). Occupational Health Bi-Monthly, Vol. 12, Issue 1, March-April 2015.

Nouri Fard, A. & Farzian, M. (2008). Sustainable Architecture against Earthquakes: Design of a Middle School in Tehran, Fine Arts Journal, (36), 37-48. [SID](https://sid.ir/paper/5731/fa).

Organization for Economic Cooperation and Development. (2013). PISA 2012 Results: What Makes Schools Successful? Resources, Policies and Practices (Volume IV). PISA. OECD. doi: 10.1787/9789264201156-en

Razmi, H.R. & Gholami, M. (2020). Analysis of Architectural Design Principles for Schools from a Passive Defense Perspective, Architecture Studies, 17(3): 236-251.

Soleymanpour Omran, M. et al. (2021). Islamic Lifestyle with Health Focus Quarterly, Vol. 5, Issue 1, Spring 2021.

United Nations Development Programme(UNDP)., (2004), Reducing Disaster Risk: A Challenge for Development, A Global Report, New York: UNDP–Bureau for Crisis Prevention and Recovery (BRCP).

Zargari & Haji Ebrahim et al. (2007). Passive Defense in Architecture as a Risk Reduction Strategy for Natural Disasters, Third International Conference on Comprehensive Crisis Management for Unexpected Natural Events, Tehran, 2007.