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Strategies for disaster risk reduction education: A systematic review

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Abstract:

INTRODUCTION: For many years, numerous researches and risk reduction activists have emphasized the importance of public awareness and education for disaster risk reduction (DRR). These needs, due to human natural manipulation, have increased. The present study was aimed to assess and determine the evidence on the strategies for education of DRR.

MATERIALS AND METHODS: This study was a systematic review of publications and gray literatures regarding to strategies for education of DRR conducted in December 2016. Fifteen articles and dissertations published during January 1, 2000 to December 31, 2016 were extracted through PubMed, Scopus, ProQuest, Web of Science, ScienceDirect, Ovid, Google Scholar, Scientific Information Database, Magiran, and Irandoc with the inclusion criteria of English and Persian language. Thematic analysis technique was used to analyze the articles.

RESULTS: The thematic analyses revealed eight major categories of DRR educational strategies such as raising knowledge, educational needs assessment, educational planning, educational approaches, educational content, educational tools, involved organizations, and educational learning barriers and challenges.

CONCLUSIONS: Most countries have launched DRR education activities, but these actions are not enough, and there are some gaps between what is it and what should be. More effective and efficient teaching and learning strategies are needed to increase the effectiveness of preparedness and DRR activities at all levels of community.

Keywords:

Disaster management, disaster, education, qualitative study, risk management, risk reduction, strategy

Introduction

In recent century due to human alteration of nature, people around the world have become more and more vulnerable to numerous types of hazards and disasters.^[1] Disasters can occur anywhere and at any time and overwhelms the capability of existing resources to cope with.^[2,3] In the last decade (2006–2015), 6270 disasters have been recorded in five continents resulting in 8,197,666 deaths, 70,597 casualties, and 1,989,866,263,000 dollars economic damage.^[4,5] Although these events lead to some extensive human, material, economic or environmental losses and impacts,

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appropriate disaster mitigation and risk reduction activities could reduce the effects of them.^[1,6-8] Modern approach to disaster management is disaster risk management which focuses on mitigation and risk reduction.^[6-8] Disaster risk is a product of the interaction of hazard and the vulnerability conditions of the society or elements exposed. Disaster risk reduction (DRR) is the concept and practice of reducing disaster risks through systematic efforts.^[9] Researchers such as Taheri-Azad and Taheri-Azad surveyed the role of education in reducing natural disasters effects and confirmed the positive impact of education on reducing the risk of disasters.^[10,11] Based on the Hyogo Framework for Action and Sendai Framework, education and training are priority activities and strategies for DRR.^[12-14]

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Education is a process that must be integrated at different levels of management and practice and has a positive effect on community knowledge and attitudes for risk reduction.^[15,16] These proper education and training could raise community knowledge and understanding to change behavior.^[17] Therefore, in this study, we conducted a systematic review to assess and aggregate the evidence on the strategies for education of DRR.

Materials and Methods

Systematic search

This study is a systematic review of publications and gray literatures relating to strategies for education of DRR. The latest search was conducted in December 2016. Articles and relevant dissertations published during January 1, 2000 to December 31, 2016 were extracted. International databases such as PubMed, Scopus, ProQuest, Web of Science, Scindirect, Ovid and Google scholar, and Iranian National Databases such as Scientific Information Database, Magiran, and Irandoc were searched using the keywords of disaster, education, strategy, and risk reduction. The authors of the included studies were contacted as needed too. The search was restricted to title, abstract, and key words and search themes were combined using the Boolean operator "AND" and "OR."

(One example of search strategy in Web of science is:

TI = (disaster * OR hazard * OR emergency * OR crisis * OR catastrophe OR incident * OR event * OR chaos OR natural disaster * OR natural hazard * OR natural phenomena OR Earthquake * OR Flood * OR Drought * OR Storm * OR Typhon * OR Hurricane * OR Avalanche * OR Volcanic * OR landslide * OR Climate change * OR Epidemic*) AND TI = (education * OR train * OR learn * OR teach * OR tutor * OR instruct*) AND TI = (Model * OR framework * OR theory * OR pattern * OR organize * OR structure * OR guide * OR plan * OR program * OR science * OR outline OR map OR diagram OR perspective OR illustration OR platform OR database OR chart*) AND TI = (risk OR threat OR danger * OR Difficult*) limited to 2000–2016, English articles = 22 RECORD).

Study selection

Duplicate results from the searches were eliminated with Endnote v. 8 it is produced by Clarivate Analytics, previously by Thomson Reuters Corporation. the Thomson Reuters was created by the Thomson Corporation's purchase of the British company Reuters Group in April 2008, that is a Canadian (Toronto) multinational mass media and information firm.^[18]

The title and abstracts of the papers were reviewed by the authors to select papers. The inclusion criteria for the study were: articles published in English and Persian and

date of publication from 2000 to 2016 and difficulty to access to the full text of some papers is the limitation for this study. In addition, the reference lists of the reviews were searched to identify other studies that meet the inclusion criteria. The selected publications were then read in full.

Data extraction

Descriptive and thematic analysis was performed for the included articles and literature. One author extracted data from the included studies into an extraction datasheet with an emphasis on descriptive and thematic variables [Tables 1 and 2]. The accuracy and completeness of the extracted data were checked by other authors and some experts.

Results

Study selection

In total, 792 studies were retrieved up to December 2016, including 781 references from international databases and 11 references through national databases. Of the 792 retrieved references, 270 references were excluded because of duplication, 350 references did not meet the objectives of this review and 157 did not follow the eligibility criteria [Figure 1].

Study characteristics

Fifteen studies were included in the qualitative synthesis. The largest numbers of papers (60%) are related to Middle-Eastern countries. Most papers (60%) are related to recent years (2010 onward). In terms of methodology, the majority of studies (40%) were qualitative and quantitative. The most collection tools for data (40%)

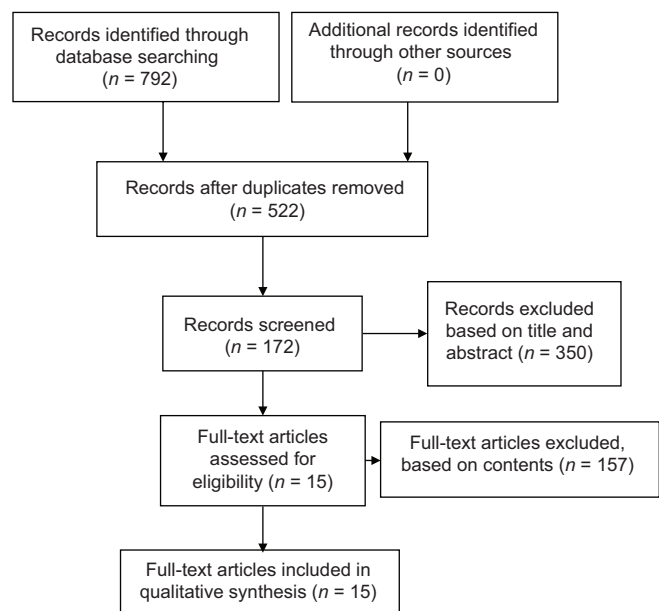


Figure 1: Flow diagram of the search and selection of paper (PRISMA Flow Chart Diagram)

Table 1: Descriptive papers analysis for the systematic review of literature

Author(s) reference number	Country	Year	Methodology	Data collection tools	Data analysis method
Radjak and Redmond ^[4]	England	2014	literature review	Data extraction form	Content analysis
Apronti <i>et al.</i> ^[11]	Ghana	2015	Qualitative and quantitative	Questionnaire Interview Focus group discussion	Content analysis
Karnawati <i>et al.</i> ^[20]	Indonesia	2010	Action research	-	-
Izasdkhah <i>et al.</i> ^[24]	Iran	2007	Action research	-	-
Prashar <i>et al.</i> ^[23]	India	2013	Qualitative and Quantitative	Questionnaire Interview Focus group discussion	Content analysis
Efthymis <i>et al.</i> ^[19]	Greece	2014	Quantitative	Questionnaire	-
Chen <i>et al.</i> ^[21]	Taiwan	2012	Qualitative and quantitative	Data extraction form	Content analysis
Yeager <i>et al.</i> ^[38]	America	2015	Literature review	Data extraction form	Content analysis
Roy <i>et al.</i> ^[42]	India	2000	Literature review	Data extraction form	Content analysis
Musacchio <i>et al.</i> ^[34]	Italy- Spain-Island Portugal	2014	Qualitative and quantitative	Data extraction form questionnaire Interview	Content analysis
Baytiyeh ^[35]	Lebanon	2014	Qualitative	Interview	Content analysis
Perry <i>et al.</i> ^[22]	America	2003	Literature review	Data extraction form	Content analysis
FitzGerald <i>et al.</i> ^[46]	Australia	2010	Qualitative and quantitative	Data extraction form Interview	Content analysis
Siripong ^[14]	Thailand	2010	Literature review	Data extraction form	Content analysis
Mohebbifar <i>et al.</i> ^[47]	Iran	2008	Qualitative and quantitative	Data extraction form Questionnaire	Content analysis

were data extraction form. The greatest data analysis method (80%) was content analysis [Table 1].

Thematic analysis

The extracted themes through the thematic analysis were opted by consulting with the experts and research team in this study and contain factors affecting on DRR education and their strategies that classified to some determinants and components [Table 2].

Discussion

Effective determinants and components of DRR education strategies are discussed as follows:

Strategies for raising knowledge

One of the best strategies for raising knowledge is transferring accessible information with appropriate quality.^[17] Another strategy to promote knowledge is using a team approach and community involvement.^[19] This active, collaborative, enquiry-oriented activity share knowledge and helps to understand subjects and finally lead to raise knowledge.

Educational needs assessment

Needs assessment is used to study knowledge, ability, interest, or attitude of involving audience or group to design effective educational programs. Need assessment for DRR education includes the

following steps: 1 – preliminary assessment of current DRR programs and researches;^[12] 2 – hazard and risk mapping;^[1,20-22] 3 – hazard prioritization; 4 – assessing the disaster vulnerability, exposure, and resiliency and their priorities;^[1,14,20] 5 – determining the target group and their strengths, weaknesses and capacity, and appropriate educational time and tools for each group.^[22-24] These steps are proposed and confirmed by Shadel and Vangeest study, which was used a questionnaire survey, a self-administered mail, and focus group for educational needs assessment.^[25,26] One study pointed out the age of participant, whereas this study did not indicate it, while there are different educational needs in different ages.^[27]

Educational planning

Based on this study for DRR planning, authorities and planners must consider the experience of academics, experts, and texts,^[17,21] which is according to another study defined getting some advices from advisors in educational planning.^[28] Cervero *et al.* agree with this study and emphasized not only on the participation of experts and authorities but also involving individuals and groups in the process of educational planning, designing, and administrating.^[29] In DRR planning process; political, physical, economic, social, and religious situation, age, gender, job, needs, priorities, awareness, knowledge, experience, capabilities, perception, understanding of individuals, and setting

Table 2: The findings and thematic papers analysis for the systematic review of literature

Author(s) reference number	Determinants of DRR education	Findings of study 1=Strategies for raising knowledge, 2=Educational needs assessment, 3=Educational planning, 4=Educational approaches, 5=Educational content, 6=Educational tools, 7=Involved organizations, 8=Educational barriers and challenges
Components of DRR education		
Radjak and Redmond ^[4]		1: Disaster terminology standardization-education of concepts of risk assessment-risk communication and dissemination-information availability, promote community involvement 4: Integration of DRR education into formal basic and advanced curricula-Research based education-establishment of academic multidisciplinary majors-establishment of disaster data center-publications-education of private institutions and local people-professional training for personnel's of disaster's involved organizations-promote the participation of disaster specialists and specialist organizations in planning and implementing of DRR 6: Textbooks-public education campaigns-mass media-e-learning 7: Ministry of education and training-higher education centers
Apronti <i>et al.</i> ^[1]		1: Education for officials, managers, and children 2: Hazard, vulnerability and risk mapping, and prioritization-assessing the region's disaster vulnerability, exposure, resiliency and their priority-determining and prioritizing the vulnerable groups 5: Attention to age and Gender 6: Textbooks-museums, exhibitions and fields visit-participation in disaster safety and prevention exercises-e-learning. 7: Ministry of education and training 8: Gaps between the disaster education outlined in the syllabi and what taught in the classroom-lack of enough communication between school, family, and community-lack of educational resources (teachers, facilities, and equipment)-lack of professional training for teachers-lack of coordination, cooperation, and collaboration between the involved units and being inconsistency in DRR interventions
Karnawati <i>et al.</i> ^[20]		2: Hazard, vulnerability, and risk mapping 4: Integration of DRR education into formal advanced curricula-Research based education-establishment of academic multidisciplinary majors 6: Textbooks 7: Higher Education Centers
Izasdkhah <i>et al.</i> ^[24]		1: Education of officials, managers, children woman, elderly, local people, and taxi drivers 2: Determining target groups, their strengths, weaknesses, and capacity, their specific education tools, methods and the appropriate educational time 3: Considering the political, physical, economic, social, and religious situation, age, gender, job, needs and priorities, awareness, knowledge, experience, capabilities, perception, understanding of individuals and their setting 4: Integrated community-based disaster management program with the reinforcing coordination, cooperation, and collaboration of disaster's involved organizations 6: Textbooks-interactive online and offline games, sing and song, educational animations, painting, poster-discussions with peers-multimedia CDs-museums, exhibitions, and fields visit-participation in disaster safety exercises-participatory rural appraisals-educational meetings-participation in parents and teacher's school associations-mass media-e-learning-training videos, booklet, pamphlets-educational courses of red cross and red crescent for volunteers 7: Ministry of Education and Training-health-care providers systems-religious institutions-merchants-municipalities-governmental and non-governmental organizations
Prashar <i>et al.</i> ^[23]		2: Determining target groups, their strengths, weaknesses, and capacity, their specific education tools, methods, and the appropriate educational time 3: Considering the political, physical, economic, social, and religious situation, age, gender, job, needs and priorities, awareness, knowledge, experience, capabilities, perception, understanding of individuals and their setting 4: Having community action plan 5: Notice to the job and people residence, the family, social and economic status, religion, level of awareness, perception, and understanding and individuals needs and priorities
Efthymis <i>et al.</i> ^[19]		4: Establishment of disaster data center 6: E-learning

Contd...

Table 2: Contd...

Author(s) reference number	Determinants of DRR education	Findings of study 1=Strategies for raising knowledge, 2=Educational needs assessment, 3=Educational planning, 4=Educational approaches, 5=Educational content, 6=Educational tools, 7=Involved organizations, 8=Educational barriers and challenges
Components of DRR education		
Chen <i>et al.</i> ^[21]	<p>2: Hazard, vulnerability and risk mapping, and prioritization-assessing the region’s disaster vulnerability, exposure, resiliency, and their priority-determining and prioritizing the vulnerable groups</p> <p>4: Integration DRR education into formal basic and advanced curricula-train the trainers-research based education-establishment of academic multidisciplinary majors-integrated community-based disaster management program with the Reinforcing coordination, cooperation, and collaboration of disaster’s involved organizations, units and departments-evaluation of effectiveness of Educational program</p> <p>6: Textbooks-educational meetings-participation in parents and teacher’s school associations-e-learning</p> <p>7: Ministry of education and training-higher education centers</p> <p>8: Lack of disaster prevention literacy in authorities, officials, managers, teachers, students and people–noninclusion of disaster prevention education in the formal curricula-education of the some hazards of the area not all hazards-high disaster vulnerability of structures, nonstructures and infrastructure-lack of enough training the trainers-lack of unified administrators to manage and assess disaster prevention education</p>	
Yeager <i>et al.</i> ^[98]		<p>4: Use of mass media capabilities (social networks) due to high, risk communications-change the attitude of people in regards to DRR-availability and adequacy of training resources</p> <p>6: Mass media</p>
Roy <i>et al.</i> ^[42]		<p>6: Educational animations-interactive 3D simulations-training videos-e-learning technology</p>
Musacchio <i>et al.</i> ^[34]		<p>4: Integration of DRR education into formal basic curricula</p> <p>6: Educational animations-museums, exhibitions, and fields visit-e-learning-conferences, festivals, training videos</p> <p>7: Ministry of Education and training-health-care providers systems-religious institutions-merchants – municipalities-governmental and non-governmental organizations</p>
Baytiyeh ^[35]		<p>4: Integration of DRR education into formal basic curricula-promote the participation of disaster specialists and specialist organizations in planning and implementing</p> <p>6: Textbooks-interactive online and offline games-educational animations, poster-training videos-museums, exhibitions and fields visit-participation in disaster safety and prevention exercises-educational courses of red cross and red crescent for volunteers</p> <p>7: Ministry of education and training-health-care providers systems-religious institutions-merchants – municipalities-governmental and non-governmental organizations</p>
Perry <i>et al.</i> ^[22]		<p>2: Determining target groups, their strengths, weaknesses, and capacity, their specific education tools, methods, and the appropriate educational time</p> <p>3: Expert’s consultant-considering the political, physical, economic, social, and religious situation, age, gender, job, needs and priorities, awareness, knowledge, experience, capabilities, perception, understanding of individuals and their setting</p> <p>4: Integrated community-based disaster management program with the reinforcing coordination, cooperation, and collaboration of disaster’s involved organizations</p> <p>5: Attention to age, gender, job, and residence-considering the family, social, and economic status, religion, level of awareness, people’s needs and priorities, perception and understanding</p> <p>7: Policymakers, police forces, military system, firefighting, prehospital emergency services, and hospitals</p>
FitzGerald <i>et al.</i> ^[46]		<p>2: Initial assessment to identify the existence of disaster education programs and researches</p> <p>3: Preparing the initial training framework by reviewing the texts, writings, academic, and governmental experts association</p> <p>4: Identifies the levels for education and determine the appropriate content for each level-including DRR programs into postgraduate programs</p> <p>5: Attention to age, gender, job, and residence</p> <p>7: Higher education centers-national cooperation council on disaster health education and research-governmental organization</p>
Siripong ^[14]		<p>2: Hazard prioritization-assessing the region’s disaster vulnerability, exposure, resiliency, and their priority-prioritizing the vulnerable groups</p> <p>4: Active and direct family and community participation in school DRR activities-provide some laws and law enforcement actions-funding support by local, national, and international organizations</p> <p>6: Interactive online and offline games-dance-painting-poster-theaters and plays-museums, exhibitions, and fields visit-participation in disaster safety and prevention exercises-installing the appropriate signs of disaster in public-writing competition</p> <p>7: Higher education centers-the media-community agencies-stakeholders-citizen groups-some foreign agencies</p>
Mohebbifar <i>et al.</i> ^[47]		<p>7: Policymakers-police forces-military system-firefighting-prehospital emergency services and hospitals</p>

DRR = Disaster risk reduction

of people must be considered.^[1,4,21,22] Giangreco *et al.* suggested a different educational planning for disabled students and children to be added.^[30] Lopez *et al.* and some other researchers proposed that identifying key groups and recognizing their new educational needs and the potential changes, are the first step in planning.^[27,31-33]

Educational approaches

In this study, a large number of papers (40%) indicated that the best approach to educate DRR is the integration of disaster prevention education into schools curricula.^[1,19,20,22,34,35] Some researches approved this as they concluded that children are the most vulnerable groups in the past disasters because of their physical breakability, need for emotional care, and dependency on others for decision-making.^[36,37] This study suggested some activities and direct participation of students in DRR actions.^[1,20,38] This is consistent with other studies such as Squire.^[39] Some papers of this study insisted on the integration of DRR programs into higher education.^[1,19,20,22] Use of mass media capabilities (social networks and media) due to high-risk communications is another new educational approach for DRR. Community leaders and disaster managers, by engaging with these social media, have the potential to improve health outcomes by optimizing communication within each disaster phase. Social networks and media, despite many benefits, have some disadvantages such as sharing invalid information, therefore, controlling the content of the sharing information help low cost and effective DRR activities deliveries.^[40] Based on the 33.4% of papers, an integrated community-based disaster management program and coordination, cooperation, and collaboration of disaster's involved organizations is a necessity because a wrong coordination would lead to conflicts, wastes resources and result in time, human and property losses.^[19,20-22,34] Legislations and law enforcements in this regard to push communities and organization to adopt and execute the laws and also local, regional, national, and international fund activities are another necessity.^[13]

Educational content

The educational content should be designed based on target community interests such as family, social, and economic status; religion, age, gender, job, residence; and people perception and understanding their needs and priorities.^[1,19,21] This finding is confirmed with a study^[29] that defined; for preparing educational content, a quick search of related websites, educational catalogs, popular textbooks and forms, focus group discussion of native instructors who familiar with profile of the target community to know their topics of interest and priority, and getting advice from national and local educational advisor are necessary.^[29]

Educational tools

Different training tools are suggested for different groups of the community. Tools for children could be school textbooks^[1,19,20,22,34] and interactive online and offline games.^[14,22,34] Squire's study confirmed this and suggests computer and video games are the most comprehensive, and effective tool is used across the world.^[39] Additional tools including educational animations, sing and song, dance, painting, poster, theaters and plays, discussions with peers, multimedia CDs, interactive 3D simulations, disaster-related museums, exhibitions, and fields visit are introduced.^[1,20,24,34,35,41] These should be according to children age and their special learning skills and capacities. Suggested tools for education of women in countryside areas are participatory rural appraisals and in urban areas are weekly and monthly educational meetings such as community groups, participation in public educational campaigns, in the social media and in Parents and Teachers' school associations.^[1,4,24,27,29] also, the suggested tools for training of college students are e-learning and multimedia CDs.^[1,19,20,34,41] In this study, the greatest number of papers (47%) suggests the multimedia learning tools for education, which confirmed with studies of Grunwald and Corsbie-Massay and Song *et al.*^[15,42] Fisch furthermore Silver *et al.*, proposed the DRR educational advertising on television for increasing the public knowledge.^[43,44] This important and effective tool for promoting the public awareness did not find in this research. Consequently, the effectiveness of educational tools depends on selecting the appropriate educational approach also giving information in various methods. According to Fletcher study, students retain, 20% of what they hear and 40% of what they see, but 75% of what they see, hear, and interact with.^[45] Therefore, the combination of audiovisual and interactive tools is the best training tools.

Involved organizations

Forty percentage of papers pointed out the Ministry of Education and Training^[1,4,21,34,35] and some others indicated higher education centers and the National Co-operation Council on Disaster Health Education and Research,^[4,14,20,21,46] health-care providers, prehospital emergency services and hospitals, lifeline systems, religious institutions, merchants, municipalities, governmental and nongovernmental organizations such as the red cross and red crescent, the policymakers, police forces, military system, firefighting, media, community agencies, stakeholders and citizen groups, and foreign agencies should be engaged in DRR education.^[14,22,24,35,46,47]

Educational barriers and challenges

There are big challenges and barriers in DRR education. One of the most important challenges is lack of disaster prevention literacy that includes prevention and mitigation of knowledge, attitude, and skills in authorities,

officials, managers, teachers, students, and public.^[21] Furthermore, lack of disaster prevention education in the formal curricula; vulnerability of structures, nonstructural, infrastructure and people; lack of unified administrators to manage and assess the effectiveness of disaster prevention education, significant gaps between the education outlined in the syllabi and in real; lack of appropriate communication between school, family and community, and scarcity of educational resources are noted.^[1,21] Porter and Graham research is in line with the current study.^[48] The other challenge is lack of professional training for teachers,^[1,21] whereas suitable teachers' training is a critical component in disaster education.^[49] Two significant barriers in education of DRR are lack of coordination, cooperation, and collaboration between involved organizations and inconsistency of education.^[1] Because of consistent changes in the communities and organizations.^[50] Gilbert proposes some other barriers in universities such as insufficient flexibility of classes and courses, language and psychosocial barriers, economic factors, and rigid university regulations.^[51]

Strengths and weaknesses of this study

The novelty of this study, adoption to one of the priority of Sendai Framework for DRR, 2015–2030, search a large number of relevant and important databases, and using a very wide keywords for search of articles are strengths of this study. Difficulty to access to the full text of some papers is the limitation for this study.

Conclusions

In this study, effective strategies for DRR were identified which could provide a roadmap for policymakers. These strategies Contains educational need assessment, educational planning, find the best educational approaches, the best educational content and the best educational tools with notice to educational involved organizations. also having community-based educational approaches along with more effective and efficient teaching and learning policies, a dynamic and ongoing educational planning, availability of educational resources and cooperation and coordination of various involved organizations in disaster management. as well; executive power and political will,^[52] getting help from legislators to provide some laws and law enforcement actions and sufficient founding support are other important strategies for education of DRR. Given the severe problems following disasters, policymakers and managers should implement these strategies. These strategies are evidenced based in the disaster reduction and improve the resiliency in the country.

Suggestions for future research

This study set only for DRR education strategies about natural hazards; then we suggest some researches about

manmade or all hazards' DRR education strategies, also we recommend to do some studies about educational strategies for DRR in the period of 2017 onwards.

Authors' contribution

conducting the database search and systematic review, skimming through the abstracts of the searched articles to choose the relevant articles, acquisition of data, drafting of the manuscript: Nahid Aghaei. Study concept and design, Analysis and interpretation of data: Hesam Seyedin. Critical revision of the manuscript: Hormoz Sanaeinasab.

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Conflicts of interest

There are no conflicts of interest.

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