



OPEN Developing a conceptual framework for adolescent disaster resilience education in Iran

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In the realm of public education research, there exists a critical need to assess readiness and investigate behavioral changes in the context of disasters through the lens of behavior change theories aimed at modeling disaster preparedness. Despite numerous paradoxes that arise between structural factors and associated risks, the behavioral responses of adolescents in reaction to disasters remain significantly underexplored. The current study employed a mixed-methods approach and an “all-hazards” framework. The goal was to develop a conceptual model for teaching teenagers to be more resilient in the face of disasters, thereby enhancing social resilience in Iran. The present study used a mixed-method approach in four stages. The first stage was carried out by a systematic review of articles published between August 18, 2001, and August 31, 2024. The second stage involved semi-structured in-depth interviews with 21 experts and 35 adolescents chosen through purposeful sampling. In the third stage, a Delphi questionnaire was designed to measure the components and reach expert agreement, and the level of importance of each extracted factor was evaluated with the participation of 20 professors and experts in disaster management. Finally, by holding a panel of experts according to the results of the previous three stages, the model of adolescent disaster resilience education was designed to improve social resilience in Iran. The results of the present study proposed a model of adolescents’ disaster resilience education to improve social resilience, which consists of four main parts, including governance perspectives, need-based education, social participation, and scope of influence. Identifying the influential factors and components in adolescent disaster resilience education and measuring the agreement of experts about the components by determining the priority and importance of each component in developing disaster education programs can be very effective in improving the resilience of adolescents against disasters.

Keywords Education, Adolescents, Resilience, Disasters, Model

The examination of existing literature indicates that public education initiatives have been framed within the context of behavioral change theories to enhance disaster preparedness. Ejeta’s study highlights the predominant utilization of several theoretical models, namely the Health Belief Model (HBM), the Extended Parallel Process Model (EPPM), the Theory of Planned Behavior (TPB), Social Cognitive Theory, and Protection Motivation Theory (PMT). These frameworks have been employed to evaluate disaster readiness and to explore behavioral adaptations during various disasters, including influenza pandemics, flooding, seismic events, and climate change phenomena¹. A significant focus of these studies lies in assessing the efficacy of these models in predicting the diverse components of human behavior related to disaster preparedness.

The results of this study indicate that certain models, such as the extended parallel process model, the theory of planned behavior, and the health belief model, are effective in the realm of emergency preparedness. However, the chosen analysis methods used to demonstrate the relationships between different structures, the types of risk, and the effects of mediating variables reveal several paradoxes¹. Furthermore, several studies have focused on specific age and social groups, primarily adults and vulnerable populations such as pregnant women and the elderly. However, adolescents have received relatively less attention. In the limited research conducted on this age group, their issues and social challenges have been analyzed primarily through the lens of behavior change models^{2,3}.

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Despite the passage of many years since the United Nations declared the International Decade for Natural Disaster Reduction and the initiation of the United Nations International Strategy for Disaster Reduction, there remains a significant lack of reviewed and published documents on effective disaster education mechanisms for adolescents. There is no comprehensive study examining the roles and experiences of adolescents throughout all phases of the disaster management cycle. Additionally, the existing discussions regarding adolescent participation in disaster risk management often merely reflect issues related to children's participation. These discussions typically focus on child-oriented disaster risk reduction programs and analyses of children's involvement in philanthropic efforts⁴.

Most existing studies on adolescents have primarily concentrated on risk education programs conducted in schools by teachers⁵. These educational interventions tend to focus on specific hazards. In contrast, the all-hazards approach of the presented model demonstrates a more comprehensive understanding compared to previous studies.

The resilience of a person is not only theoretical knowledge that can be achieved only through school education, but also requires different types of learning (visual, verbal, logical, and mathematical), organizational skills, spatial thinking, and accurate decision-making⁶. Therefore, disaster education programs should include different methods, programs, and mechanisms other than the traditional format and acquiring passive knowledge⁷, which requires the identification of effective factors and components in resilience education. And there are disasters. Therefore, the research question of this study is: What educational factors can have a significant impact on disaster resilience among adolescents during disasters?

The present study has three main objectives:

- 1. To identify the influential factors and components involved in disaster resilience education for adolescents, based on research findings and expert opinions.
- 2. To assess the level of importance of each component in disaster education, to enhance adolescents' resilience.
- 3. To develop a conceptual model for adolescent disaster resilience education aimed at improving social resilience.

According to definitions provided by the World Health Organization and UNICEF, adolescents are defined as individuals aged between 10 and 19 years.

Methods

The present study was carried out in four stages in 2024 in a mixed method.

Systematic search

A systematic review was carried out between August 18, 2001 and August 31, 2024 through PubMed, Cochran Library, Scopus, Science Direct, Web of Science and ProQuest and three Persian language databases. Articles were selected based on search keywords including four dimensions: "resilience", "disasters", "adolescents", and "education". The search strategy used is shown in Table 1.

At this stage, the processes of identifying, screening, and confirming the qualifications of the articles were done based on the PRISMA guidelines (Graph 1)⁸. All methods were conducted in accordance with the relevant institutional guidelines and regulations.

All articles relevant to the research purpose were considered, regardless of their methodology or language. The studies covered various types of hazards, including natural, human-made, and technological events. We selected qualitative, quantitative, and mixed-method articles that addressed the research question and included the specified keywords in the title, abstract, or keywords. Articles that included the term "adolescent" or its equivalents but did not focus on the 10–19 age group, or that did not report results specifically related to this age group, were excluded from the review. A descriptive and thematic analysis was performed in the systematic phase of the review for the existing articles and literature. The characteristics of the articles that were extracted are summarized in Table in the appendix¹. Data were extracted by two researchers. Two data collection forms were used to extract the data. The first form included the general characteristics of the articles, including the name of the article and the authors, the country where the study was carried out, the year of publication, the study sample, the method of conducting the study, and the data collection tools. In the second form, influential factors in disaster education to promote the resilience of adolescents in disasters and their details were extracted, and summary forms were completed for each of the selected articles. Citation and publication biases were also

PIO	#1 AND #2 AND #3 AND #4	Strategy
P	Adolescent OR Child* OR Youth OR Teenage* OR Young	#1
I	Disaster OR Event OR Crisis OR Hazard OR Phenomena OR Catastrophe OR Risk OR Danger OR Threat OR Vulnerable OR Incident OR Accident OR Emergence OR "Natural Disaster" OR Earthquake OR Flood OR Drought OR Storm OR Typhoon OR Hurricane OR Landslide OR Covid-19 OR Epidemic OR "Climate Change" OR Fire OR Volcanic OR Cyclone OR Tornado OR Tsunami OR Pandemic OR Terrorism OR "Mass Casualty Incident" OR "Mass Casualty"	#2
O	Resilience OR Resilient OR "Psychological Resilience" OR "Community Resilience" OR "Disaster Resilience" OR "Disaster Resiliency" OR Coping OR Sustainable	#3
	Education OR Curriculum OR Teaching OR Workshop OR Training OR Program OR School OR Tutoring OR "Community Education" OR "Social Education" OR "Community Learning" OR "Social Learning" OR "Community disaster"	#4

Table 1. Search strategy.

considered, and the articles with high citations were also carefully reviewed. The Coreq⁹, Cosmin¹⁰, and Strobe¹¹ tools were also used to evaluate the selected final articles.

Interview

At this stage, in-depth and semi-structured interviews were conducted with experts and specialists in the areas of health in disasters and emergencies, public education, communication and risk communication, and crisis and risk management. Also, interviews were done with adolescents to find out what they thought about disaster education and disaster resilience.

Inclusion criteria for key informants were to have at least a master’s degree in the field of disaster management or in the area of public education; to have work experience in the area of disaster management or in the area of public education; to have executive records and related research.

The sampling method was a purposeful sampling method. An interview was conducted with them after explaining the goals and importance of the research to the participants and obtaining their consent. The numbers #1, #2 and ... were used to name people. People’s names were not entered into the demographic forms. The demographic characteristics of the participants are detailed in Table 2.

The open and semi-structured interview questions were such that experts were asked to talk about disaster education to increase the resilience of adolescents against disasters. Also, while talking about the relevant topic, many other aspects of the opinions of the interviewees that were raised during the conversation were examined. Also, other probing questions were asked. Each interview lasted about 45 to 75 min, and finally the interviews were terminated when the data was saturated. A total of 56 interviews with 21 experts and 35 adolescents were conducted, and the data were analyzed using thematic analysis to extract the components and factors of disaster education to increase the resilience of adolescents in disasters. Thematic analysis was performed through a manual methodology. This involved the identification and extraction of key concepts from the data items, to which initial codes were assigned. These codes were then systematically organized into sub-main categories and overarching main categories. This structured approach allowed for a comprehensive exploration of the themes embedded within the data set. To ensure the accuracy of qualitative data, Guba and Lincoln criteria were used¹². Accordingly, the researcher examined the data with measures such as long-term involvement and direct observation, peer review, review by participants, review by the researcher himself, and triangulation technique.

Integration and validation of components

After extracting the components and factors affecting the education of adolescents’ resilience in disasters, to measure the level of importance of the components and reach agreement of the experts at the third stage, a Delphi questionnaire was designed, which included categories and sub-categories obtained from the systematic review and interview. It was distributed among key informants for surveying and reaching agreement. The key informants were selected purposefully. A Delphi questionnaire was sent to 20 professors of disaster and emergency health and public education experts and specialists, and 18 of them responded to its questions.

To determine the content validity, Delphi rounds continued until reaching agreement. To analyze the results of the Delphi rounds, three ranges of “accepted,” “need to review,” and “rejected” were defined. Accordingly, the components of the questions that scored between 25 and 75% were sent to the key informants for review; the components of the questions with a score of less than 25% were excluded; and the components of the questions with a score of more than 75% were approved.

Expert panel and conceptual model design

At this stage, the objectives of the study were first explained to the experts. Then, the components and the degree of importance of each component, obtained from the Delphi stage, were explained to them to express their opinions about the schematic form of the model, the placement of the components, categories, and sub-categories. Then, during the meeting, each of the experts expressed their opinions and discussed them. Finally, according to the categories and sub-categories extracted from the study, the schematic form of the model was designed. Then, to increase the verifiability and confirmability of the schematic shape of the designed model, the extracted model was sent to 10 experts in the area of public education and health in disasters and emergencies to collect their opinions about the shape of the model. The designed model was finalized and presented with the approval of these experts.

Feature		Number
Gender	Male	20
	Female	12
Education Level	PhD	17
	PhD Candidate	4
	Student	35
Field of Study	Health in Disasters and Emergencies	10
	Crisis and Risk Management	4
	Community Education	5
	Communication and Risk Information	2

Table 2. Demographic characteristics of participants.

Results

In the systematic stage of the review, 29,856 articles were extracted from the database search. By excluding the duplicate articles and examining the title, abstract, and full text of the articles, finally 17 articles were found to be completely in line with the aim of the study. Figure 1 illustrates the flow chart of the final selection of articles. Out of the remaining 17 articles, 3 were qualitative, 12 were quantitative, and 2 were mixed studies.

After analyzing the text of the interviews, 976 codes were extracted, and by excluding the duplicate codes and re-analyzing them, the factors and components affecting the education to improve the resilience of adolescents in disasters were obtained. Examples of codes and quotations have been relegated to the appendix².

The percentage of agreement for the components obtained from the two stages of interview and systematic review, which were categorized into 4 categories and 20 sub-categories and were distributed among experts in the form of a Delphi questionnaire, was greater than 75% in the first round for all the sent components. Hence, all the components were approved. Table 3 presents the codes, categories, subcategories, and percentage of agreement obtained in the first round of Delphi.

According to the results of the previous three stages, the experts expressed their opinions about the schematic shape of the model, the placement of components and sub-categories, and finally, based on the categories and subcategories extracted from the study, the schematic shape of the model was designed. Figure 2 shows the Conceptual Model of Disaster Resilience Education for Adolescents. The figure illustrates the framework for disaster resilience education tailored to adolescents, highlighting the key components and interactions that contribute to their overall resilience in the face of disasters. This model was obtained from the results of three stages of systematic review, qualitative study, and Delphi, performed during the holding of a specialized panel with the presence of experts from fields related to the research topic, with the aim of presenting a conceptual model for adolescent disaster resilience education. It consists of four main parts, including governance perspectives,

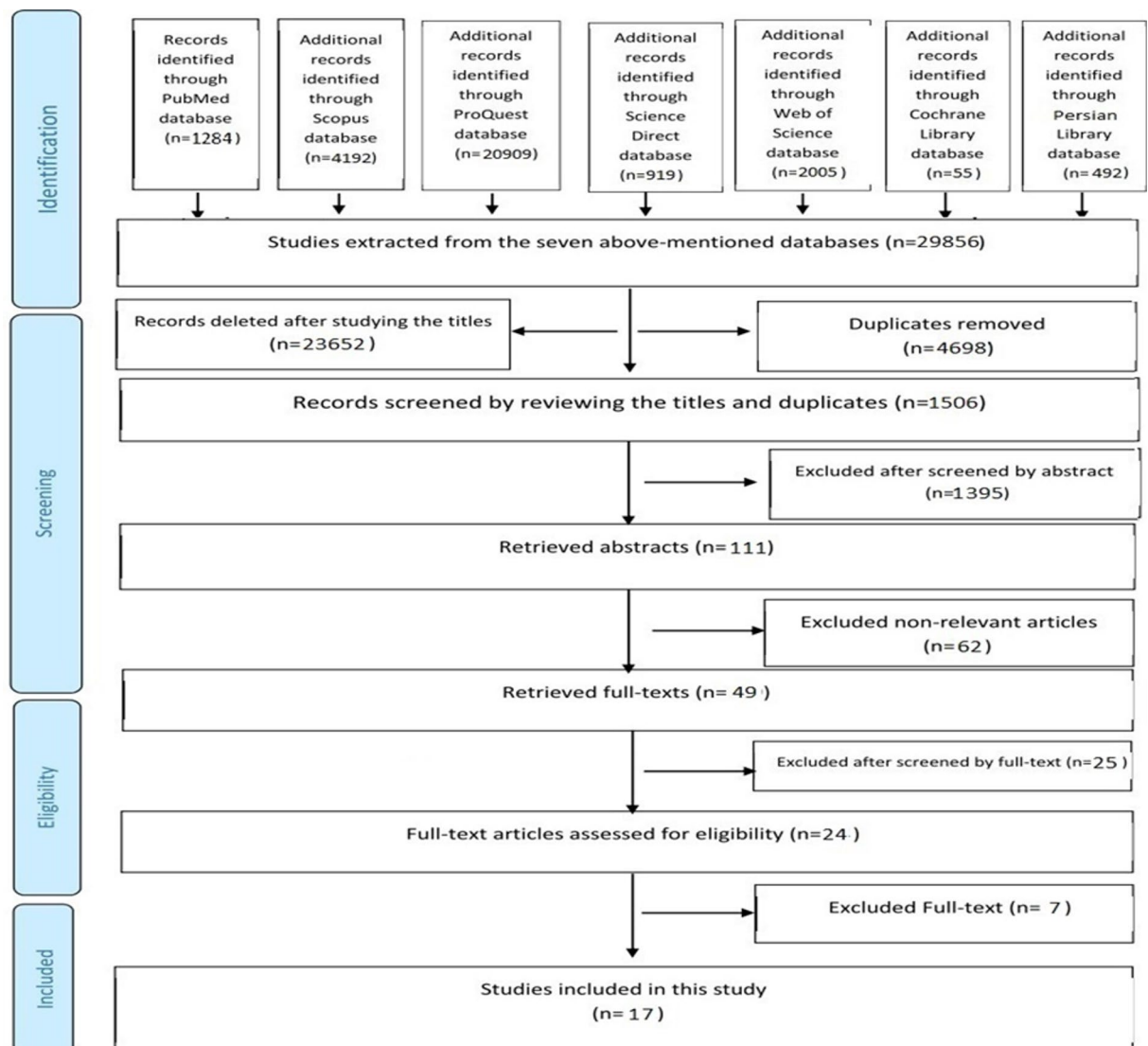


Fig. 1. PRISMA flow diagram for the systematic review process.

Category	Subcategory	Meaning units	Percentage of agreement
Social participation	Social impact	Adolescents' effectiveness in the behavior of adults and peers	85.29
	Organizations and social associations	Involving groups and associations and creating educational campaigns	80.88
	Social sensitization	Social beliefs and participation in a social task	85.29
	Parents and family members	Involvement of family members in children's educational affairs	86.76
Need-based education	Formal education	Including educational content in textbooks or providing a disaster-related course	76.47
	Continuity	Continuation, persistence, and repetition of disaster education programs	92.65
	Educational content	Attractive content based on the needs and interests of adolescents	92.65
	New technologies	Capacities of computer games such as disaster simulator games	92.65
	Indirect education	Indirect messages without fear or coercion, education in form of games	83.82
	Practical and skill training	Deep learning and skill development with training and practical exercises	91.18
	Characteristics of adolescents	Education effectiveness, personality and age traits in adolescents	79.41
Governance perspectives	Critical infrastructure	Comprehensive development of the country and strengthening of infrastructure	83.82
	Specialism	Capacity of specialists in disaster management structures and planning	89.71
	Localization	Experiences of successful countries and localization of their programs	94.12
	Policies	The government's intention for policy-making and planning for disaster education	94.12
	Scientific research	Governmental support and directing research and academic projects to disaster-related issues	85.29
	Capacity Building	Training and increasing the information of administrators and teachers about disasters	91.18
Scope of influence	Communications and media	Strengthening communication and information in the media and cyberspace	97.06
	Organizational interaction	Coordinated activity of responsible organizations	76.47
	A comprehensive and focused program	Comprehensive and centralized process planning	80.88

Table 3. The codes, categories, subcategories, and percentage of agreement obtained in the first round of delphi.

need-based education, social participation, and scope of influence. The central core of the presented conceptual model is adolescent disaster resilience education, where the main categories and sub-categories play the role of lower layers, strengthening the possibility of achieving the ultimate goal of the model, improving teenagers' resilience in disasters.

Based on the importance expressed by experts, as extracted from the Delphi stage, this model was designed to ensure that the size of each component reflects its degree of significance according to the experts' opinions. For example, among the four main categories, governance perspectives are the most important, and among the subcategories, communications and media are the most important, and Organizational interaction is the least important in achieving the core of the model, namely, adolescent disaster resilience education.

Discussion

Policy-making in disaster risk reduction education, cooperation between schools and other stakeholders, and personnel and budget allocation are among the key issues in disaster education^{13,14}. Amri (2017) also demonstrated policymaking in disaster risk reduction education, partnerships between schools and other stakeholders, and staffing and budgeting as the key issues in disaster risk reduction education. Thus, organizations and departments should increase awareness of education-related policies to reduce the risk of accidents in all educational institutions¹³.

To turn knowledge into a norm, there is a need to change policy on a larger scale, focusing on school reform by identifying the capacities of adolescents to become agents of change in societies. It is necessary to change policies on a larger scale with a focus on school reform by recognizing students' potential to become agents of change in their communities. Educational content should be designed and developed based on the interests and needs of adolescents¹⁵. Mirzaei et al.¹⁶ found a significant discourse gap between policymakers and adolescents, which could undermine the effectiveness of current policies and interventions. Policymakers in Iran and other ideologically driven countries should recognize this gap and take steps to bridge it. By incorporating the perspectives of adolescents and tailoring policies to align more closely with their values, there is a greater likelihood of enhancing the effectiveness of these initiatives. Otherwise, the efforts of various groups and organizations to increase social resilience will remain fruitless.

The social participation section in the designed model is in line with the ecological and ecosystemic approach to resilience, but the presence of three other sections in the presented model shows the comprehensiveness of the model. In creating resilience based on the ecological and ecosystemic approach, the relationships between risk and protective factors are considered by emphasizing the mutual dependence between people and social systems. This approach is a useful perspective to consider resilience and its factors at the individual, family, and social levels. It does not focus on the individual, but it includes a more complex understanding of how individual and social factors interact to form personal options and structural opportunities. By using an ecosystemic approach, factors promoting and challenging resilience can be considered at the micro level (individual), at the medium level (family) and at the macro level (environment)^{17–19}.

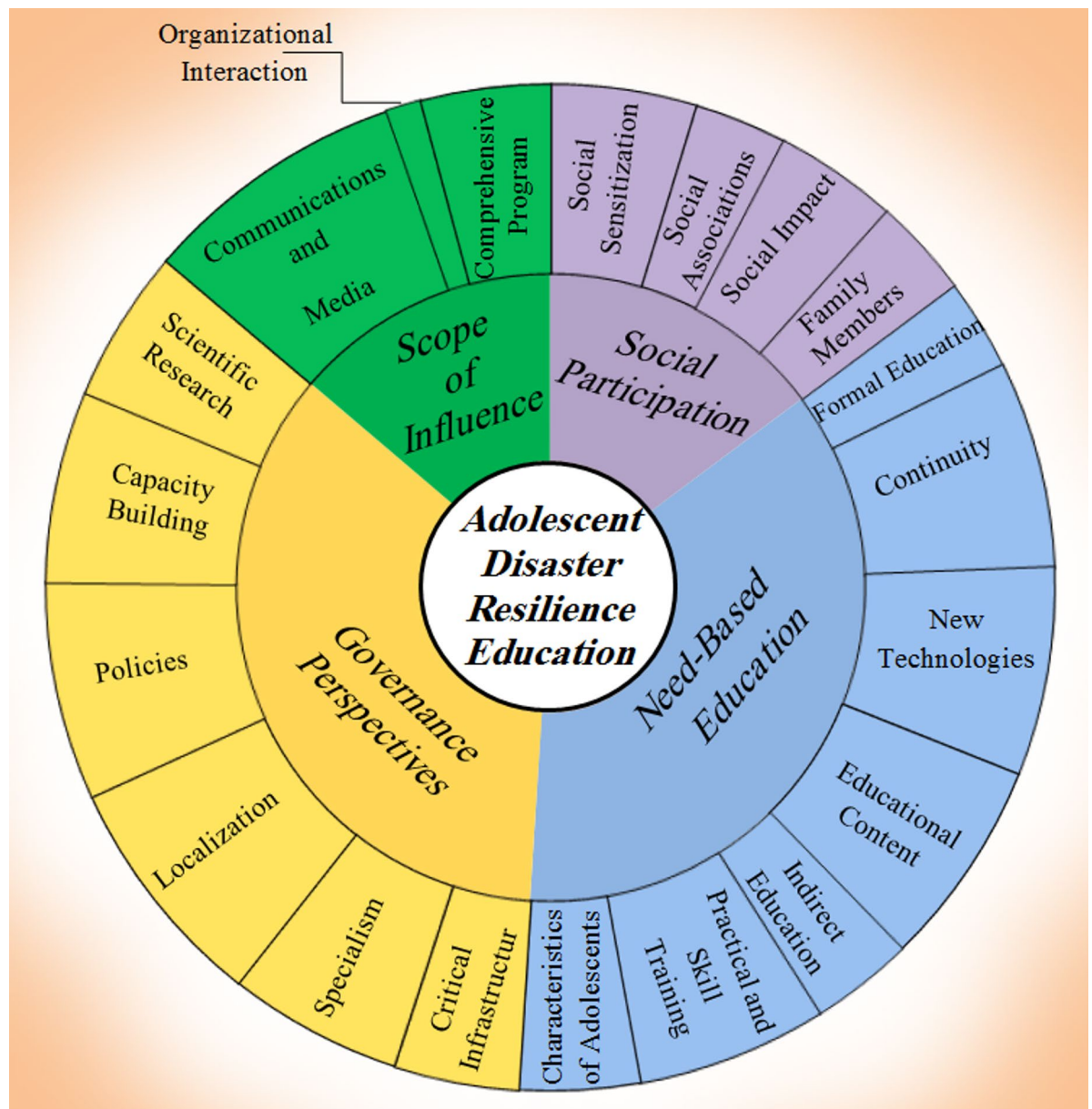


Fig. 2. Conceptual model of disaster resilience education for adolescents.

The social participation part of the model refers to the necessity of the participation of different groups of society in the resilience education of adolescents. It ranges from adolescents' parents and family members to peers, teachers and school principals, communities, groups, organizations, and various associations to which adolescents belong and participate in their programs. In other words, the results of the present study are an example of the approach of the whole society, an approach in which the important areas of resilience, family, school environment, and society are integrated in the mission of strengthening resilience through participation. It is a strategy that promotes integration and harmony in the developmental stages of children and adolescents, as well as between individual, family, and social environment factors¹⁷. One of the things this study's model does well is break down each of these factors into their parts and subcategories.

Social education and family education, along with school education and self-education, are four areas of education²⁰. The findings of this qualitative study reveal that adolescents are significantly influenced by the behaviors and actions of various individuals in society, particularly their parents and other adults. Jalala et al.²¹ further confirmed that students are deeply affected by the guidance provided by counselors, teachers, and school principals. Essentially, the appropriate responses from these figures can play a crucial role in managing students' emotions and enhancing their coping abilities. Similarly, Mooney et al.²² highlighted that teachers, school principals, and peers serve as vital sources of confidence and empowerment for students, promoting resilience, self-support, and adaptability in addressing their needs. In this way, these individuals can greatly assist adolescents in their adaptation and recovery processes. Parents' participation in educational programs

is a more effective way to achieve disaster risk understanding and resilience. If the risk-related interactions with parents were better, the children's knowledge, behavior, and understanding of risk would be higher^{23,24}. The findings presented by Zhong et al²³ suggest that knowledge acquired through television and interpersonal interactions with peers significantly contributes to the behavioral development of adolescents. Furthermore, the research highlights the Internet's pivotal role in enhancing children's awareness of disasters, establishing it as the predominant medium for fostering resilience among students²¹. Also, adolescents will have positive impacts on their parents' knowledge of disasters, and thus the quality of the child and parents' relationship will positively affect the success of intergenerational learning effects²⁵.

Based on the Strengthening Systems 4R (Risk Reduction, Readiness, Response, and Recovery) Prevention Model or SS4R, the school-adolescent-family link as an important social network can connect a school or an educational program to families through the learning and enthusiasm of the adolescent and lead to the improvement of society's resilience, so that families can not only increase their readiness, but can also increase resilience through other networks in the society to which these families and educational facilities are connected⁵. Also, increasing the interaction between parents and schools and encouraging and participating families can result in more readiness measures and an increase in the level of resilience^{26,27}. Teachers, peers, coaches, and family members all help with the learning process, and having good relationships with both friends and teachers is a big part of how resilient students are (28, 4).

According to the strategic goals of the World Conference to reduce vulnerability in the face of disasters, development and strengthening of institutions, mechanisms, and capacities at all levels, especially at the level of communities, can systematically lead to the creation of resilience against risks^{28,29}. Improving disaster resilience requires a comprehensive and focused program through which adolescents will learn various educational subjects during the process and finally achieve the desired goal of the program. Measures related to disaster risk reduction should be based on multi-hazard, multi-sector, inclusive and accessible approaches to be efficient and effective³⁰⁻³⁸. Education is a long-term, time-consuming, and ongoing process, so it is necessary for managers and officials to change their attitude from performing quick-impact projects to long-term projects. Given the extent of different types of disasters, education and information should be in the form of flow and process. Wherever an accident happens, adolescents can apply some of what they have learned.

The results of the present study have various implications, such as creating a new perspective for policymakers and planners regarding adolescents, since this age group is vulnerable and can strengthen their skills and resilience in disasters with proper education. Establishing common goals that align the missions of different ministries (e.g., between ministries of education, health, and youth affairs) facilitates a collaborative environment where each sector can contribute its expertise. Also, encouraging ministries to co-develop policies that address overlapping areas, such as education and health, to create a unified approach to adolescent resiliency and make a resilient society is vital. In addition, they are a source of motivation in society, and by affecting other family members and peers, they can lead to the strengthening of social resilience and facilitate ways of achieving sustainable development. Also, this study can be very useful in planning to improve the resilience of this age group by showing the challenges and opportunities of disaster education in adolescents.

Limitations and future research

The principal limitation of the present study was the exclusive focus on adolescent students as respondents, which stemmed from challenges in identifying, accessing, and securing consent from a broader adolescent population. Consequently, it is recommended that future research endeavors seek to evaluate the perspectives of adolescents who are not enrolled in formal educational settings. Additionally, further investigations should aim to distinctly assess the role and relative significance of each of the components identified in this study.

Conclusion

The present study proposes a model of adolescent disaster resilience education to improve social resilience. It consists of four main parts, including governance perspectives, need-based education, social participation, and scope of influence. The central core of the presented conceptual model is adolescent disaster resilience education, where the main categories and sub-categories play the role of lower layers, strengthening the possibility of achieving the ultimate goal of the model, improving teenagers' resilience in disasters. Identifying the influential factors and components in adolescent disaster resilience education and measuring the level of experts' agreement about the components can be very effective in increasing the adolescents' resistance against disasters and achieving a resilient society by determining the priority and importance of each component in developing disaster education programs to improve resilience. By contextualizing the framework within the Iranian educational landscape, we aim to provide a relevant and practical tool for policymakers and practitioners seeking to address the needs, resilience, and development of Iranian youth.

Data availability

All data generated and analyzed during this study, and its supplementary information files can be made available upon request to the corresponding author.

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Author contributions

HKK, RR, and MP designed the project, contributed to supervision, and revised and corrected the manuscript. HKK, RR and MAM coordinated and helped to draft and finalize the manuscript. HKK, MAM, and RR performed data acquisition and interpretation and wrote the manuscript. All authors read and approved the final

manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The authors consider themselves obliged to comply with the common ethical principles governing the publication of scientific publications, which are specifically defined in the guidelines of the International Committee on Publication Ethics (COPE). After obtaining the necessary permissions and receiving a letter of introduction from the Research Deputy of the faculty, introducing themselves to the participants and explaining the goal of the study, the researchers assured the participants that all the points recorded during the interview would remain confidential and they could leave the interview process at any stage of the research. Participants who agreed to participate in the study were selected and informed consent to participate was obtained from all of the participants in the study. The study was approved by the Shiraz University of Medical Sciences Ethics Committee (Approval No. IR.SUMS. NUMIMG.REC.1400.018).

Additional information

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