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Review

Trends in Civic Engagement Disaster Safety Education Research: Systematic Literature Review and Keyword Network Analysis

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Abstract: Background: Education plays the most important role in establishing a disaster management system by creating a safety culture in the community and by engaging its members. This study explored the trends in research on disaster safety education based on the community from the perspective of lifelong education. Methods: We undertook a systematic literature review and keyword network analysis. The main search keywords were "community", "disaster", "safety", and "education". The subjects of education were adults, including disaster-vulnerable people, such as elderly and disabled people. A total of 185 articles and papers were identified and then narrowed down to 56. Results: Research related to disaster safety education has developed in a direction that reflects the characteristics of disasters that occur in the region. Currently, disaster safety education is being studied in various fields, including the humanities, social sciences, and engineering, focusing on disaster prevention. The main research methods in the reviewed literature were qualitative, especially case studies that applied narrative, storytelling, and risk scenario construction. Conclusion: The study provides a framework for the in-depth analysis of disaster risk management and risk level of communities, and lays the academic foundation for it.

Keywords: civic engagement; disaster safety education; community; disaster management; lifelong learning

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1. Introduction

Since the Fourth Industrial Revolution, modern society has been suffering from the worsening effects of social disasters, such as fires, explosions, and collapsing structures, as well as natural disasters, such as typhoons, heavy rains, and heat waves that result from rapid industrialization, urbanization, and population concentration [1,2]. In recent years, natural and social disasters have been occurring in combination, making disaster management difficult in terms of prevention, preparation, response, and recovery. The risk of multiple disasters is increasing further because secondary damage can occur.

For the mitigation of the effects of disasters, it is more efficient to minimize the occurrence of damage and devise continuous management measures by preparing systematic initial responses based on pre-disaster prevention and countermeasures, rather than follow-up management, such as response or damage recovery [3,4]. According to previous studies, the key factors of continuous emergency management are improving the safety awareness of the people and securing disaster response capabilities by upgrading them [2,5–7]. As part of an effective disaster management plan, it is very important to form a locally-based safety community. The locally-based safety community is a group with a practical approach that recognizes disasters as a problem of the whole society and cooperates to solve this problem [8,9]. It is a civic group that conducts safety activities at the local level. It is also an organization that has the ability to respond to disasters in the area and to aid in recovery in the event of a disaster. Furthermore, it functions to improve the disaster resilience of the

community. What is most needed to build and operate a locally-based safety community efficiently is the formation of a community safety culture, based on safety awareness, attitudes, and safety behaviors of the residents [7–9]. Education is the most important, in order to plays a role in establishing a disaster management system by creating a safety culture in the local community and by engaging its members.

In this study, a systematic literature review was used to analyze the research trends of civic engagement disaster safety education conducted both in Korea and internationally. We aimed to identify the research trends of the contents, methods, research fields, and subjects of education, targeting research related to disaster safety education, and to establish the basic concepts of research on civic engagement disaster safety education. Also, by means of network analysis, we explored the relationship between keywords and research contents that are important in the relevant field. Through this process, we attempted to analyze the trends and scope of the research field of community-based disaster safety education, establish basic concepts, overcome the fragmentation of the research, and lay the academic foundation for research on disaster safety education in Korea.

2. Theoretical Background

2.1. Definition and Characteristics of Civic Engagement Disaster Safety Education

Disaster safety education is a form of lifelong education centered on the community [2,6–10]. Preston et al. [10] conducted a study considering education to prepare for emergencies as a form of lifelong learning. They emphasized the importance of civic engagement in carrying out safety and security learning in everyday life. They also suggested continuous education, campaigns, and active community learning to improve residents' safety awareness, and suggested ways to induce people's participation through discourse, learning about urban disasters, along with learning about natural disasters. A study by Thayaparan et al. [11] argued that disaster safety education can be activated through informal, nonformal, and formal learning alike because organized education has limited knowledge about disaster resilience and disaster management. It was explained that education to reinforce the ability to respond to special situations such as disasters should reflect the characteristics of each region and needs to be learned throughout life, which is similar to the concept of lifelong learning. In order to ensure the safety of the community from the risk of disaster, it is most important for the locally-based safety community and its members to recognize it as a common problem and to induce civic engagement and cooperation to solve the problem.

A study by Johnston [12] proposed communication between residents as an important factor for improving the effectiveness of community-based disaster safety education. It is also argued that the effects of disasters could be overcome by means of civic engagement, such as residents taking an interest in local disasters, trust between residents, and a sense of belonging to the community. Civic engagement means that people get together to form a single community to respond to various risks [13]. In addition, civic engagement is based on people's dedication to improving disaster response and resilience to overcome and prevent disasters in the community. Civic engagement can be defined as a concept of an ecosystem to identify disasters that occur frequently in communities, recognize risks, and facilitate interaction, participation, and communication among people within each community [12–16]. The formation of a safety community by community members within a region plays a very important role in explaining how resilience is structured in the event of a disaster, and in inducing the continued participation of residents. Civic engagement can function as this safety community.

As for disaster safety education, the method or subject of education was generally determined according to the type of disaster. Research on disaster safety education was also mainly conducted to verify the effectiveness and efficiency of the education as a result of its subject or method. There is an insufficient number of comprehensive studies. There are few studies on adults who can play an active role in civic safety committees in communities. There have also not been many studies involving elderly and disabled people, who are

more vulnerable to disasters [17–20]. In addition, the aspect of "civic engagement" in community-based disaster safety education is a very important variable in determining whether civic safety committees can successfully prepare for and respond to disasters. There is a limitation in that there is insufficient research on the subject.

Civic engagement disaster safety education can be defined as education that reflects the characteristics of the region, including residents' experiences of disaster and the disaster history of the region. A community is a physical and cultural space that an individual encounters for the first time, and residents need to learn how to accurately understand and identify the dangers and disasters in the area and how to resolve the disaster [2,5–7,15]. Civic engagement disaster safety education can also function positively in building a safety culture in the community [10,12–16]. This education plays a role in organizing and materializing programs so that citizens can actively participate and commit themselves to the overall disaster management process, including prevention, response, preparation, and recovery for disasters. Janse and Konijnendijk [15] stated that disaster resilience can be secured through the knowledge of how to respond to disasters, reflecting the characteristics of each region and the safety awareness of residents, securing sustainable disaster response and resilience, communication, and information exchange.

2.2. Research on Civic Engagement Disaster Safety Education

Disaster-safety education based on communities has not been studied for a long time. The time point of research may differ for each country, but generally, the starting point is after the 2000s [6–11]. Since the Sewol ferry accident in 2014, studies have been conducted on educational content, subjects, methods, and educational effects in Korea. Most of the Korean studies on disaster safety education based on the community were mainly focused on disaster-related business workers and safety volunteers made up of local residents, with the theme of analyzing the effects of improving safety awareness [18–25]. Park [24] demonstrated that disaster safety education significantly improved the safety awareness and social capital accumulation of people, and that the role of residents in disaster management is very important. Based on these studies, we suspect that the improvement of safety awareness by means of disaster safety education improves local disaster response capabilities and can contribute to civic engagement and the establishment of a safety community. Table 1 shows the major preceding studies on civic engagement disaster safety education.

Table 1. Main previous studies on civic engagement disaster safety education.

Author(s) (year)	Subject	Education Paradigm	Main Research Contents
Simpson (2002) [26]	Earthquakes	Practical training	· Using a simulation program as a learning tool · Residents were studied as education targets
Suwa et al. (2008) [27]	Natural disasters	Action Learning	· Mention the necessity of disaster safety education reflecting regional characteristics
Bosher and Dainty (2011) [13]	Natural disasters	Lecture	· Mention the need for disaster prevention education based on local communities to improve disaster resilience in communities
Katada et al. (2013) [28]	Large-scale flooding	Lecture/Practice	· Using disaster scenario analysis techniques · Applying the case of the community
Dahl and Millora (2016) [2]	Natural disasters	Lecture	· Mention the need to expand the field of lifelong education to disaster safety education
Lee (2016) [29]	Natural disasters	Lecture	· The scope of people vulnerable to disaster has been extended to multicultural families
Son (2018) [30]	Complex disasters (Fire and natural disasters)	Lecture/Practice	· Consideration of complex disasters and secondary disasters · Practical training, including disabled people as learners

Table 1. *Cont.*

Author(s) (year)	Subject	Education Paradigm	Main Research Contents
Cooper et al. (2020) [31]	Complex disasters	Lecture/Practice	· Lecture/practice education using web-based simulation · Research on sustainable education plans to prepare for disasters through web-based interaction

3. Methods

The study aimed to identify the trends and major issues of research related to civic engagement disaster safety education. The systematic literature review method was chosen as the most suitable method because it reduces the potential internal bias with a scientific method. This research method defines the search criteria from the start, selects published research data, and provides summary information on the existing literature [32–35]. A systematic literature review consists of four main steps: search process, inclusion and exclusion, data extraction, and synthesis and evaluation; these are summarized [35,36]. "Civic engagement" is a term that encompasses concepts such as the participation of residents, dedication, and commitment as key concepts in this study. The researchers analyzed the keyword frequency and network of the extracted articles, and also used the word cloud technique. The word cloud is one of the representative text mining techniques used in big data analysis, and is characterized by intuitively showing the frequency of the corresponding keyword in the text by determining the size of the character according to the frequency [36–40].

3.1. Data Collection

The search period for literature was from September 24 to October 23, 2020. The languages used for the search were English and Korean. The following Internet databases were searched: Korean Studies Information Service System (KISS), Korean Education and Academic Information Service (http://www.riss.kr accessed on 10 February 2020), National Digital Science Leaders (NDSL), Database Periodical Information Academic (DBpia), Google Scholar, Science Direct, Web of Science, Springer, Scopus, and SAGE. We systematically analyzed and reviewed the searched literature data on previous studies related to research trends, research fields, community commitment, and educational effects. Among the searched articles, we excluded literature that was not regularly reviewed, such as academic conference material and symposium materials. The reason for excluding them is that papers published in academic journals go through strict screening procedures, so we judged that their research results were more objective [38,39]. In order to collect literature suitable for research purposes, we set up the topic keywords, as follows, and used them for our search: "disaster", "education", "safety", "community", and "civic engagement". "Disaster" included natural disasters, such as earthquakes, floods, and typhoons, and social disasters, such as fires, collapses, and explosions. "Education" included various phrases with similar meanings, such as training, teaching, learning, and drilling. "Safety" was used in combination with key search words; specifically, we did a search by including "safety education", "disaster safety education", "community-based safety education", and "safety training" in the search keywords. In addition, "community" and "civic engagement" were also combined and used for researching the searched documents, for example, "safety community", "civic engagement community", and "community-based disaster education". We did not place restrictions on the year of publication of the literature. This is because disaster safety education for residents based on civic engagement is a field where research began in the 2000s, so the amount of literature is very small compared to other fields.

In the process of collecting literature, we applied the PICO process. This is a method that can structure a search strategy suitable for research goals and is widely used in literature review and meta-analysis [39–41]. First, "Participants" (P) refers to the subjects of the study; "locally-based civic engagement" and "disaster safety education" were set

as the keywords related to community-based disaster safety education. Second, "I" is for "Intervention" in this study; the following criteria were set and searched for this: types of disasters (natural disasters, social disasters), education method (lecture type, training type), and educational content. Next, "C" is for "Comparison"; since we did not conduct a comparative study with education other than disaster safety education, we did not establish a comparative group. Finally, "O" is for "Outcomes", indicating the results of searching the literature. We selected the literature collected by means of the settings related to the effectiveness and evaluation of disaster safety education.

In this step, we applied keywords, including "community commitment", "civic engagement", "safety community", and "citizen participation", to specifically confirm the effectiveness of education. Since civic engagement disaster safety education for a citizen safety committee was the subject of the study, we excluded studies on regular education, such as safety education and vocational education, for various safety managers conducted in elementary and secondary schools.

3.2. Selection of Articles for Systematic Literature Review

The systematic literature review was carried out in the four stages of "literature search, screening, selection, final extraction", according to the PRISMA criteria. Figure 1 shows the process of deriving research data by means of a systematic literature review. In the literature selection stage, we searched 185 articles and added 12 studies by searching research reports from governments and companies in addition to papers. After we excluded 42 duplicates or non-original texts, there were 155 papers remaining for selection.

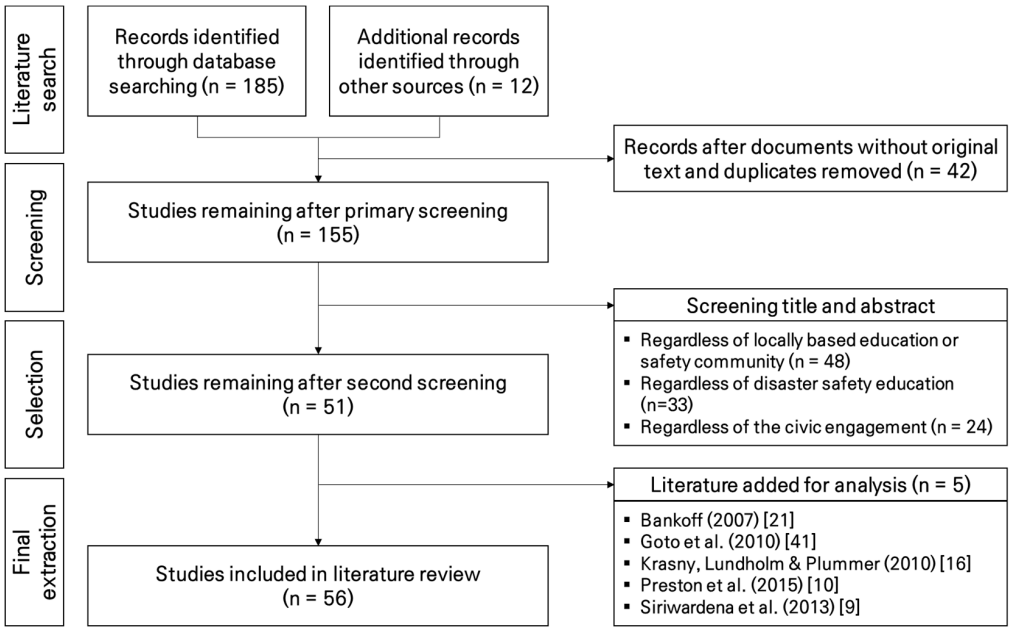

Figure 1. Flow chart of the process of literature extraction for research.

In the screening phase, a total of 105 articles were excluded. Specifically, we excluded 48 articles related to disaster safety education included in the regular curriculum. The regular curriculum includes school safety education, or facility safety education, which are not related to the safety community. Since the subject of the study was disaster safety education, we excluded 24 studies, such as safety education in hospitals and laboratories, emergency education for firefighters, and cardiopulmonary resuscitation education. We conducted a search by limiting the education targets to residents, and disaster-vulnerable people, including disabled people, who were also included as education targets. We excluded education targets composed of only children or medical/safety-related professionals from the analysis because the education was not intended for residents. However, we did not exclude civic safety education where adolescents and younger children participated together

with adults. In this process, 33 articles were excluded. We also excluded 24 studies because they were not about civic engagement or civic participation. After the selection, there were 51 documents remaining.

In the process of reviewing the selected literature, we discovered several new papers and added them to our analysis. In order not to omit essential data in this study, we additionally reviewed literature related to community commitment, disaster case studies, and citizen participation [9,10,16,21,41]. The specific reasons the documents were included in the study are as follows. A study by Bankoff [21] presented the importance of experience in preparing for the risk of natural disasters. Through this study, it was suggested that it is necessary to study and teach not only the theoretical characteristics of natural disasters, but also the characteristics of disaster occurrence unique to the community. A study by Goto et al. [41] suggested the development of educational methods for residents to participate in education to respond to disaster situations and secure sustainable disaster response capabilities. The study emphasized the importance of residents' participation and commitment. Three additional studies [9,10,16] suggested the importance of education for securing resilience in the community, and the research of Siriwardena et al. [9], in particular, noted that such education should be studied in the field of lifelong education. Finally, 56 articles were selected as research and analysis data in the literature on civic engagement disaster safety education.

3.3. Data Coding for Keyword Network Analysis

There were 56 articles finally selected for keyword network analysis. The researchers used R, an open-source software program, for keyword network analysis, and used the Bibliometrix package among the R packages, and applied the package command "cocMatrix()" for matrix concatenation [42]. The keywords presented in the literature data were applied to the analysis as they were, but the final keywords were derived by means of several refinements. Data refinement was performed according to the method published by Kim and Mun [42], and as described in the next paragraph.

Singular and plural nouns were unified in the singular form. Keywords that could be classified with similar meanings were unified as representative words that could be used with a comprehensive meaning. The final keyword was derived by means of a cleaning process, such as removing spaces or applying a hyphen ("-"). For example, "disaster" and "disasters" were analyzed as "disaster", "study" and "studies" as "study", and "risk" and "risks" as "risk". "engagement", "participation", and "commitment", which have similar meanings, were integrated into "engagement". For adjective–noun combinations, such as "community engagement" or "disaster risk reduction", the researchers used a hyphen ("-") to mark them as one word, such as "community-engagement" and "disaster-risk-reduction", so that they could be recognized as one keyword. Ultimately, 624 keywords were derived from the refining process.

For the analysis of the data, the researchers first extracted keywords related to civic engagement and disaster safety, and measured their frequency of occurrence. In the next step, the frequency analysis results were visualized in a word cloud. After that, by means of network analysis, the researchers plotted the relationships between keywords as a network plot, derived the keywords with a frequency of three or more, and analyzed the network structure of the keywords to confirm specific connectivity. The colors of nodes were randomly set in the program.

4. Results and Discussion

4.1. Overview of Studies Related to Civic Engagement Disaster Safety Education

To understand the quantitative and qualitative trends of the research and to explore the direction of future research, we established a reference frame and analyzed the research data for each characteristic. In line with previous studies on literature reviews, it was useful to identify the publication year of the studies, the ground model and theory, the type of disaster, the subject and background of the study, and the level of analysis [38–41].

We added an analysis on the subject of education and research field to the framework. We tried to confirm the research field in which research related to disaster safety education is currently being conducted. To study the types of disasters that reflect regional geographic characteristics, such as earthquakes, landslides, and typhoons, one must first understand the relationship between related disciplines. In regions such as Japan and Iran, studies related to disaster safety education reflecting regional characteristics as a field of regional lifelong education were being done. Therefore, we judged that there would be academic significance to analyzing research using the corresponding reference frame.

4.1.1. Year of Study and Ground Theory/Model

By confirming the publication year of the research on disaster safety education based on the community, we confirmed that such research has been published since 2002. In Korea, it has been confirmed that research materials have been published since 2003. We determined that there was little difference in research content between the studies published in the 2000s and the studies published in the 2010s. That is, academic discussions in the field of civic engagement disaster safety education have only been conducted since relatively recently.

In the ground theory/model, there were 21 studies (37.50%) on community-based learning, which was the highest. Most theories and models of disaster safety education and related research were based on qualitative research. Specifically, studies were conducted to reflect the characteristics of the local community, such as community-based experiential learning theory, constructivist learning theory, disaster case studies, the risk scenario error method, storytelling techniques, and indigenous learning [2,41,43], probably because disasters have unique characteristics, such as social climate and geographical conditions, in each region; hence, learning about related experiences is important to effectively respond to a disaster. Next, 10 studies (17.86%) were done to evaluate the effectiveness of methods such as educational effect analysis, role acting, education and training, feedback, and game learning theory. In addition, studies were conducted on civic engagement, disaster resilience, civil safety community, and disaster risk reduction (DRR). Figure 2 presents the content.

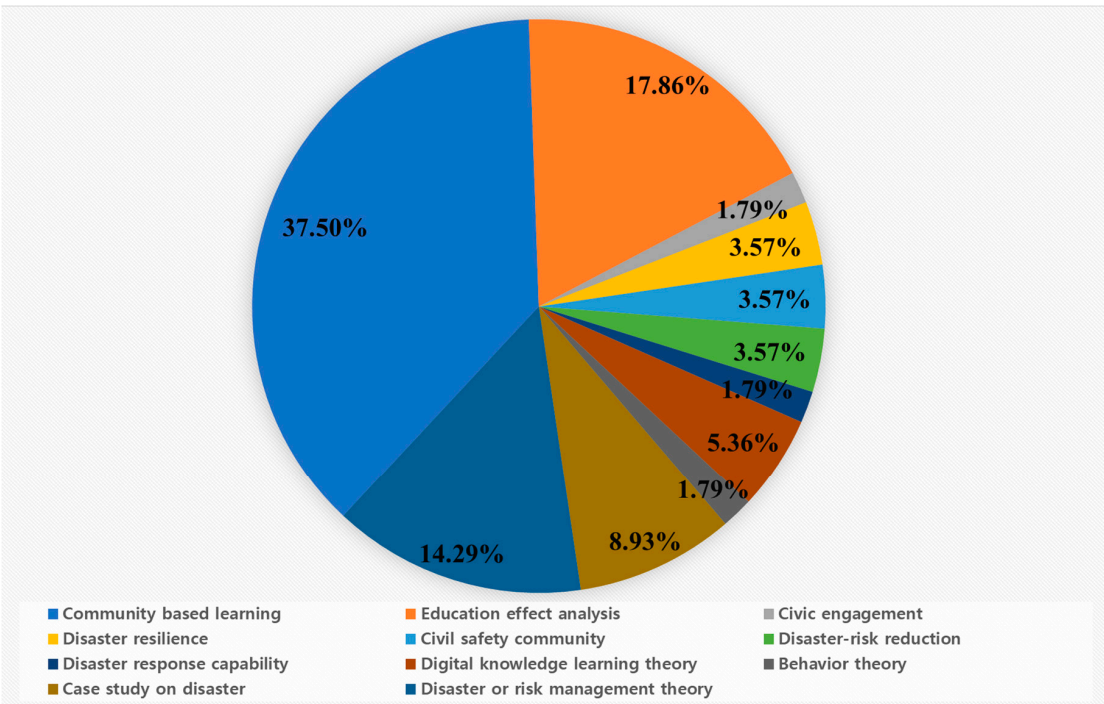

Figure 2. Pie chart of the ground theory/model.

The researchers found that the field of research on disaster safety education focuses on various case studies. In order for residents to increase the importance of disaster preparedness and safety awareness, it is possible to secure its effectiveness by developing and distributing educational programs reflecting the characteristics of disaster risk in each community. According to a study by Ryan et al. [43], in order to understand the distribution of disaster vulnerabilities in each region based on the community and to establish disaster resilience, it is imperative to conduct case studies on disasters tailored to local characteristics. Various cases of disasters can be built through the experiences of residents or existing geographic data, and a disaster safety education program tailored to the community can be developed by applying risk scenario techniques [44–56].

4.1.2. Research Field

Research on disaster safety education based on communities has been conducted in diverse fields. A total of 22 studies (39.29%) were conducted on disaster prevention, an area where continuous research is being conducted. The second most prevalent topic was education, with 10 cases (17.86%). In addition, there were four in the field of policy studies, and two studies were conducted in the fields of sociology, firefighting, and community sociology. One study was conducted in each of the following research areas: business administration, engineering, urban planning, design, urban social engineering, social science, psychology, arts and sports, safety engineering, safety and health, political sociology, geology, public administration, and occupational medicine. Figure 3 presents the research fields.

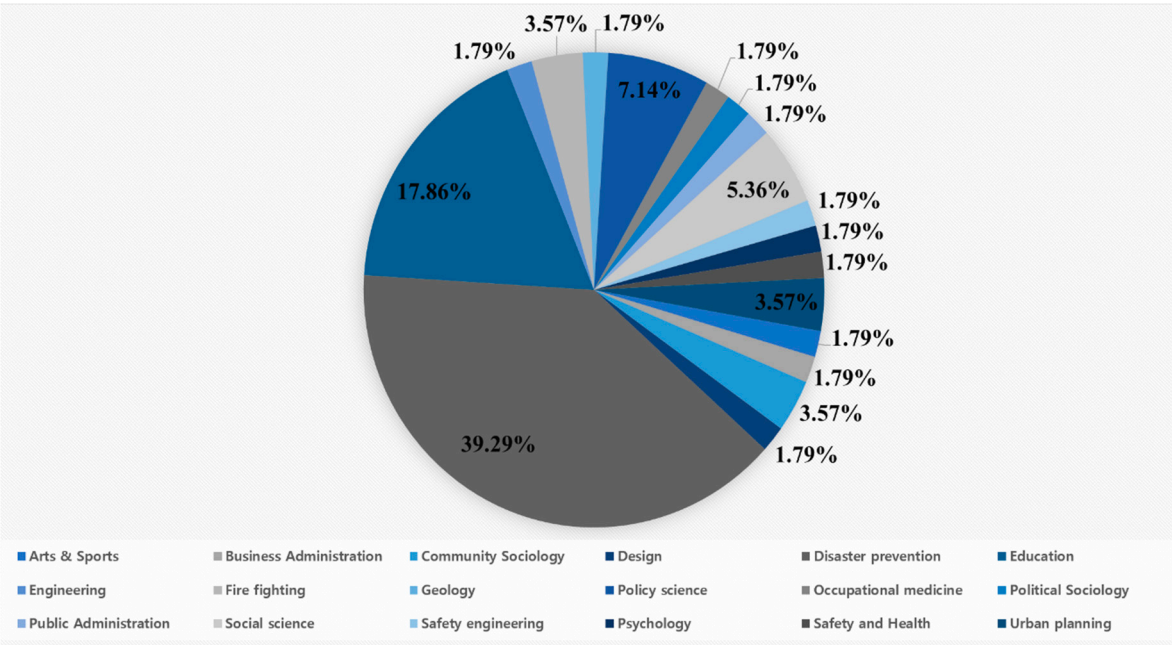

Figure 3. Pie chart of the research fields.

Active participation and engagement of residents are essential factors for improving the disaster response capacity of the local community and reducing the risk in the event of a disaster. Research on civic engagement disaster safety education is being conducted in various fields, because an interdisciplinary system is needed to induce active participation and engagement by local residents, establish risk-related scenarios based on disaster case studies, and develop and operate educational programs effectively. It has many characteristics of interdisciplinary studies.

A study by Tuohy et al. [57] suggested that community-based disaster safety education needs to be studied in the field of lifelong education. The purpose of community-based lifelong education is to satisfy residents' learning needs, restore communities, and strengthen

residents' abilities to participate independently. Civic engagement disaster safety education meets this purpose. Ryan et al. [43] argued that, given the nature of the disaster, convergence studies in various fields need to be conducted. In order to improve the safety and disaster response capacity of the community, it is necessary to construct a disaster occurrence scenario by reflecting the pre- and post-disaster situation in the area as a whole [57–62]. Doing so requires academic convergence in the fields of disaster prevention, community sociology, and public administration. Community-based disaster safety education should be conducted by means of interaction rather than by transfer of general knowledge, and a new network should be established by means of civic engagement.

Currently, disaster safety education is mainly carried out in the field of education or disaster prevention. However, because of the independent progress in each field, there is a limit to the creation of education and training scenarios, because of a lack of expertise in disaster or education programs. Therefore, it is necessary to conduct trans-disciplinary research that considers both theoretical and practical aspects, such as developing and operating a program for performing education after establishing a disaster scenario based on a specific local situation and geographic factors.

4.1.3. Education Target and Disaster Type

The researchers analyzed studies on people, who were divided into general people and disaster-vulnerable groups (e.g., elderly people, disabled people, and foreign workers) and found that, out of the 56 studies, 8 (14.29%) were related to people who are especially vulnerable to disasters. There were seven studies on elderly and disabled people, and one study, published in Korea [63], on multicultural families. In the event of a disaster, elderly people may incur more damage because they might have less physical response ability than younger adults [30,44,62–64].

In addition, when there are language differences, as may be the case with multicultural families or foreign workers, the exposure to risks is relatively high because of an insufficient understanding of the situation. Analysis of domestic and foreign research trends so far seem to show a lack of research on education for groups of people who are more vulnerable to disasters. Figure 4 shows the details.

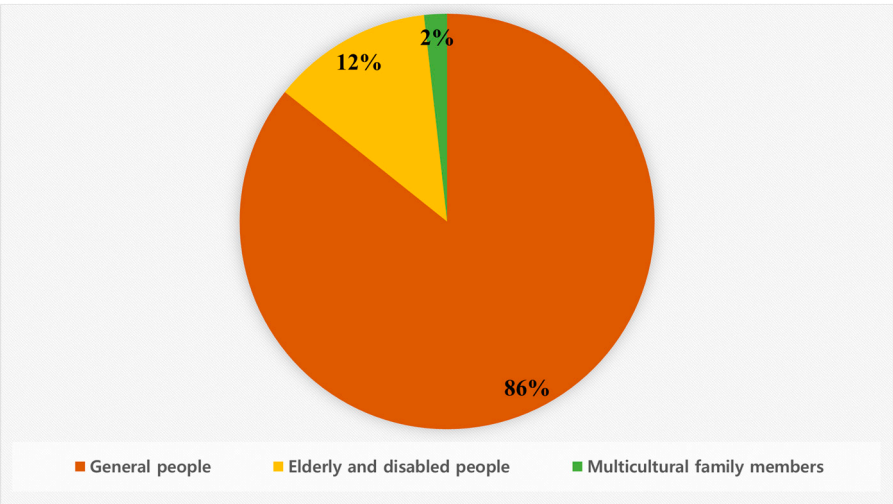

Figure 4. Pie chart of the classification of learners.

In terms of disaster types, 17 studies (30.36%) related to complex disasters dealt with social and natural disasters comprehensively, 2 studies (3.39%) dealt only with social disasters (specifically, fire), and 36 dealt only with natural disasters (61.02%). A study dealing with complex disasters was about the collapse of buildings and houses because of earthquakes, heavy rains, floods, and typhoons. The studies conducted on natural disasters were mainly case studies and studies on the risk factors that occur mainly in the local

community [7,10,54]. The studies dealing with natural disasters as educational content were disaster safety education studies based on disaster cases in the region. However, they had a limitation in that the education program was formed based on the characteristics of general disasters, not education reflecting the situation of each region. Figure 5 shows the classification of the types of disasters.

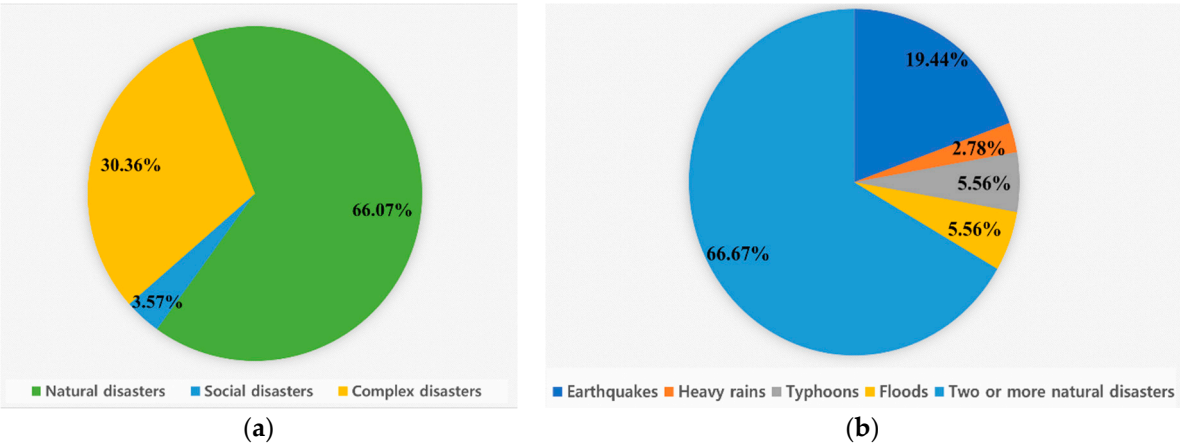

Figure 5. Pie chart of the types of disaster; (**a**) the proportion of total disasters in the curriculum; (**b**) the detailed composition of natural disasters.

In the studies of social disasters, education contents were mainly conducted on how to train for the initial response and evacuation in situations such as fires, explosions, and collapse [48,64]. In these studies, mixed-method research was applied to develop education programs to increase their effectiveness. Quantitative research methods were applied to verify the effectiveness of the developed educational program, but qualitative research methods, such as case studies and narration, were applied at the stage of developing the educational programs [64–75]. A study by Steen-Hansen et al. [64] conducted investigations and studies on fires in the country to establish cases of the cause and danger. The established cases were applied as a database to an educational program on effective disaster response and management.

It is necessary to analyze cases of each disaster in order to educate about natural and social disasters. To analyze the case of a disaster, qualitative research methods should be applied, such as storytelling, narration, and ethnographic research. Residents' experiences of disasters in each region would be the most valuable database for disaster safety education. Table 2 presents the results of analyzing the literature data.

Table 2. Systematic literature review analysis results.

	Author (s)	Ground Theory/Model	Disaster Type		Research Areas	Education Target	
			Social	Natural		General People	Vulnerable People
1	Dahl and Millora (2016) [2]	University–local government cooperation education system		•	Education	•	
2	Kitagawa (2016) [6]	Case-based disaster scenario		•	Education	•	
3	Salajegheh and Pirmoradi (2013) [7]	Civic engagement/disaster response capability reinforcement		•	Engineering	•	
4	Siriwardena et al. (2013) [9]	Community-based disaster case study		•	Business Administration	•	
5	Preston et al. (2015) [10]	Community-based learning		•	Education	•	
6	Bosher and Dainty (2011) [13]	Disaster risk management (DRM)/civic engagement		•	Disaster prevention	•	
7	McHugh and Klockner (2020) [14]	Storytelling	•	•	Safety engineering	•	
8	Krasny et al. (2010) [16]	Disaster resilience		•	Education	•	
9	Park and Eo (2016) [17]	Social capital theory	•	•	Education	•	
10	Bankoff (2007) [21]	Community-based disaster case study		•	Education	•	

Table 2. *Cont.*

	Author (s)	Ground Theory/Model	Disaster Type		Research Areas	Education Target	
			Social	Natural		General People	Vulnerable People
11	Simpson (2002) [26]	Community-based disaster preparedness program		•	Disaster prevention	•	
12	Suwa et al. (2008) [27]	Behavior theory		•	Psychology	•	•
13	Katada et al. (2013) [28]	Risk scenario method		•	Urban Social Engineering	•	•
14	Lee (2016) [29]	Emergency management theory/multicultural learning	•	•	Policy science	•	
15	Son (2018) [30]	Disaster education scenario technique	•	•	Social science	•	
16	Cooper et al. (2020) [31]	Digital knowledge learning theory		•	Education	•	
17	Goto et al. (2010) [41]	Community-based disaster education		•	Disaster prevention	•	
18	Ryan et al. (2020) [43]	Civic engagement Emergency management	•	•	Disaster prevention	•	
19	Kim (2018) [44]	Community-based safety network	•		Arts and sports	•	•
20	Choi and Choi (2018) [45]	Education practice community theory		•	Disaster prevention	•	
21	Annear et al. (2018) [46]	Community disaster resilience/ social safety net	•	•	Disaster prevention	•	
22	Chou and Wu (2014) [47]	Community-based integrated learning management		•	Disaster prevention	•	
23	Feng et al. (2017) [48]	Disaster resilience of local communities/informal learning		•	Disaster prevention	•	
24	Frankenberg et al. (2013) [49]	University–community education network		•	Social Science	•	
25	Imperiale and Vanclay (2016) [50]	Community learning effect		•	Community Sociology	•	
26	Jahangiri et al. (2011) [51]	Social learning theory/community-based disaster management		•	Disaster prevention	•	
27	Pascapurnama et al. (2018) [52]	University–community education network		•	Disaster prevention	•	
28	Rogayan Jr. and Dollete (2020) [53]	Community-based disaster management		•	Education	•	
29	Tanaka (2005) [54]	Community-based disaster risk management (DRM)		•	Geology	•	
30	Teo et al. (2019) [55]	The relationship between communication, culture, and disaster response capabilities		•	Disaster prevention	•	•
31	Wang et al. (2019) [56]	Community-based disaster risk management/Indigenous learning		•	Disaster prevention	•	
32	Tuohy et al. (2014) [57]	Disaster response and crisis management theory		•	Disaster prevention	•	•
33	Byun et al. (2018) [58]	Disaster resilience	•	•	Public Administration	•	
34	Park (2016) [59]	Constructivist learning theory		•	Policy science	•	
35	Seo and Cho (2012) [60]	Role acting training/education training feedback	•	•	Disaster prevention	•	
36	Oh and Park (2003) [61]	Emergency management and governance	•	•	Policy science	•	
37	Yoo et al. (2019) [62]	Public–private cooperative governance theory		•	Policy science	•	•
38	Kim and Kim (2018) [63]	Education effectiveness analysis	•		Firefighting	•	•
39	Steen-Hansen et al. (2020) [64]	Fire investigation and safety management		•	Firefighting	•	•
40	Chung (2014) [65]	Disaster safety training effectiveness evaluation	•	•	Disaster prevention	•	•
41	Lee (2017) [66]	Emergency management and safety education system	•	•	Occupational medicine	•	
42	Choi et al. (2019) [67]	Social learning theory/motivation theory		•	Social science	•	
43	Hong and Lee (2018) [66,68]	Disaster safety training effectiveness evaluation	•	•	Disaster prevention	•	
44	Chou et al. (2015) [69]	Constructivist learning theory		•	Disaster prevention	•	
45	Drzewiecki et al. (2020) [70]	Simulation learning effect analysis		•	Disaster prevention	•	
46	Engle (2018) [71]	Disaster case study		•	Urban planning	•	
47	Ho and Dzeng (2010) [72]	Blended learning effect	•	•	Education	•	

Table 2. *Cont.*

	Author (s)	Ground Theory/Model	Disaster Type		Research Areas	Education Target	
			Social	Natural		General People	Vulnerable People
48	Hoffmann and Muttarak (2017) [73]	Disaster case study		•	Political Sociology	•	
49	Lee (2018) [74]	Virtual reality education learning effect	•	•	Design	•	
50	Karanci et al. (2005) [75]	Experiential learning theory		•	Community Sociology	•	
51	Marshall (2020) [76]	Risk perception Disaster risk reduction (DRR)	•	•	Disaster prevention	•	
52	Iwahori et al. (2017) [77]	Legitimate peripheral participation (LPP)	•	•	Disaster prevention	•	
53	Suri (2018) [78]	Disaster case study/Indigenous learning		•	Disaster prevention	•	
54	Torani et al. (2019) [79]	Disaster emergency case study		•	Safety and Health	•	
55	Kim and Kim (2019) [80]	Establish an integrated education system and analyze its effects	•	•	Education	•	
56	Tsai et al. (2020) [81]	Game learning theory		•	Disaster prevention	•	

4.2. Keyword Frequency Analysis and Network Analysis

Table 3 shows the frequency of occurrence of important keywords among the keywords included in the literature analyzed. The study identified 624 keywords, and deleted nodes with unclear meanings and words that occurred fewer than three times. By means of this process, 457 keywords were extracted that appeared frequently. According to the centrality analysis presented in Table 3, the result for "Disaster" was the highest. In addition, the results were confirmed in the order of "Education", "Community", "Safety", "Engagement", and "Experience". Because "Disaster", "Education", and "Safety" were selected as the main search words, it was confirmed that "Community", "Engagement", "Experience", and "Risk" showed high values from the frequency and centrality analysis excluding those selected words. In the derived keywords, the frequency of "Fires" and "Earthquakes" was high, and there were cases where disasters were presented as "Natural" in a large category.

Table 3. Keyword frequency and centrality.

No.	Keyword	Frequency	Centrality	No.	Keyword	Frequency	Centrality
1	Disaster	146	0.319475	24	Adults	4	0.008753
2	Education	49	0.107221	25	Awareness	4	0.008753
3	Community	27	0.059081	26	Exercise	4	0.008753
4	Safety	19	0.041575	27	Human	4	0.008753
5	Engagement	13	0.028446	28	Knowledge	4	0.008753
6	Experience	13	0.028446	29	Learning	4	0.008753
7	Risk	13	0.028446	30	Simulation	4	0.008753
8	Preparedness	10	0.021882	31	Civic engagement	3	0.006565
9	Management	9	0.019694	32	Disaster education	3	0.006565
10	Fire	7	0.015317	33	Elderly	3	0.006565
11	Resilience	7	0.015317	34	Ethnicity	3	0.006565
12	Social	7	0.015317	35	Experiential learning	3	0.006565
13	Aging	6	0.013129	36	Governance	3	0.006565
14	Culture	6	0.013129	37	Importance	3	0.006565
15	Earthquake	6	0.013129	38	Local	3	0.006565
16	Lifelong learning	6	0.013129	39	Local community	3	0.006565
17	Reduction	6	0.013129	40	Multimedia systems	3	0.006565
18	Vulnerable	6	0.013129	41	Partnership	3	0.006565
19	Hazard	5	0.010941	42	Public–private	3	0.006565
20	Natural	5	0.010941	43	Qualitative research	3	0.006565
21	Prevention	5	0.010941	44	Storytelling	3	0.006565
22	Response	5	0.010941	45	Study	3	0.006565
23	Vulnerability	5	0.010941	46	Training	3	0.006565

Figure 6 visualizes the keywords related to community-based disaster safety education in a word cloud. The "Word Cloud Generator" (http://wordcloud.kr/ accessed on 10 February 2020) application was used to keywords excluding all keywords and major search terms in the literature. Figure 6a visualizes the results of applying all keywords, and (Figure 6b) visualizes the keywords, excluding "Disaster", "Safety", "Education", and "Local residents", which were used as major keywords. Looking at the word cloud in which the main search words were deleted, keywords such as "Community", "Engagement", "Experience", "Risk", "Preparedness", and "Management" were identified as the main topics, indicating that these are important factors in the field.

(**a**) (**b**)

Figure 6. Words cloud of key keywords of civic engagement disaster safety education research: (**a**) words cloud for all keywords; (**b**) excluding "Disaster", "Safety", "Education", and "Local residents".

Figure 7 presents a network map created by applying the connection centerline to the main keywords, excluding the keywords with a frequency of fewer than three. The study identified 163 connecting lines between 46 keywords. The size of the node shown in the picture means that the keyword appears frequently at the same time. In addition, the more neighbors it has, the more important the node seems to be. Connections of special significance are "Disaster–Education", "Education–Lifelong learning", "Community–Engagement", "Disaster–Management", "Disaster–Risk–Management", "Learning–Experience", and "Community–Learning". It was confirmed that the number of times appears simultaneously.

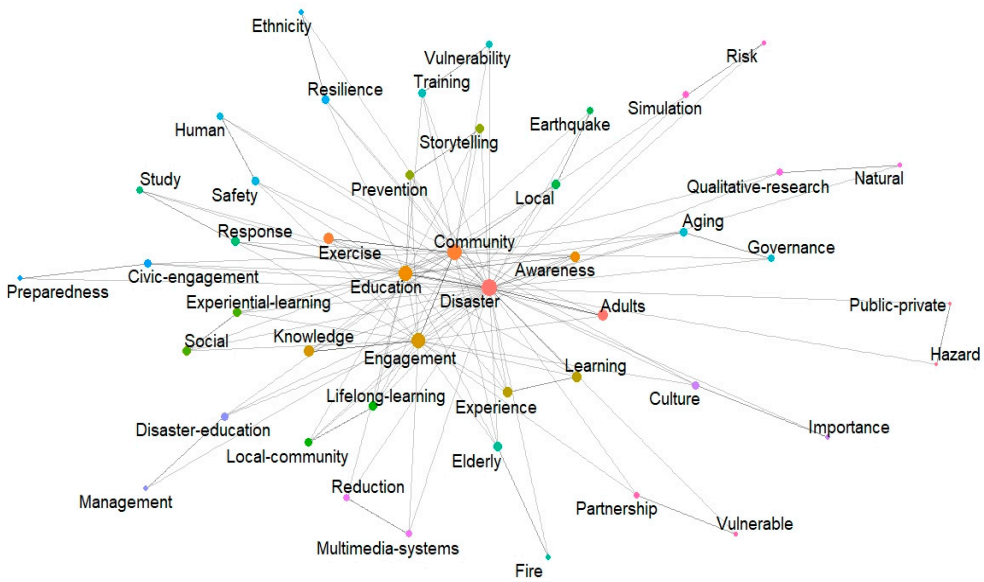

Figure 7. Keyword network map.

5. Discussion and Implications

We explored the research trends of disaster safety education based on communities and major research topics in the relevant field by means of a systematic literature review and keyword network analysis, and we derived some implications. Research into community-based disaster safety education started relatively recently; its history is not long, but the research is ongoing. In particular, research on residents' participatory disaster safety education was attracting attention as the best way to ensure an effective response to disasters, and studies on educational content, methods, and effects based on "civic engagement" were mainly conducted.

As a result of reviewing selected research, our study confirmed that most of the studies conducted case studies on the contents of disaster safety education, and included natural disasters such as earthquakes, heavy rains, floods, and typhoons. In the early stages of disaster safety education based on communities, studies were mainly conducted to include direct damage cases from natural disasters and include them in the contents of education [82]. The study found that the direction of these studies has changed from dealing with the disaster damage itself to taking into account the risk of secondary disasters, such as the collapse of facilities, fires, and explosions after the disaster.

Disaster safety education is currently being studied in various fields, mainly in disaster prevention, but also in fields such as education, public administration, geology, political sociology, sociology, and psychology. Interdisciplinary convergence is essential to induce the participation and commitment of residents to improve the disaster response capacity of the community, to manage and reduce risks, and to effectively produce and operate education programs tailored to the region. In some countries, trans-disciplinary research, such as disaster prevention and pedagogy, safety engineering and pedagogy, or geology and disaster prevention, has been conducted based on this need. Preston et al. [10] argued that education on disaster safety can improve the resilience of the community, and Kitagawa et al. [6] insisted that research should be conducted on disaster safety education in the field of lifelong education. Factors such as civic engagement, safety community formation, disaster resilience, and social capital discussed above suggest that disaster safety education provides another direction for lifelong education based on the community.

Residents who are subject to education are classified into general citizens and disaster-vulnerable groups (e.g., elderly people, disabled people, and foreign workers) Out of the 56 studies, 7 were related to the disaster-vulnerable groups. Another seven studies were done on educational programs and educational effects that consider the physical vulnerabilities of this group, but there is a limitation to unidirectional education. The study found that a study that considers various aspects of education targeting the disaster-vulnerable class is necessary.

As for disaster types, 18 studies dealt with complex disasters, 2 with social disasters, and 36 with natural disasters. Since most of these types of studies are based on real cases, an understanding of the community is needed first. Understanding from various fields is essential, such as the culture of the community, geographical characteristics, and the awareness of the residents. Lifelong education is similar to civic engagement disaster safety education, in that it aims to be immersed in the community, improve the quality of life, and foster independent people; this suggests another research direction for lifelong education.

There are several limitations to this study. Since research related to civic engagement disaster-safety education is still in its infancy, there are not many studies. The amount of accumulated information and knowledge is also very limited. We would like to make some suggestions for supplementing the limitations of this study and for conducting follow-up studies. The implications of the developmental direction of disaster safety education research for the effective management of disasters we found in this study are as follows. First, disaster safety education based on the community is closely related to the lives of residents who are subject to education in terms of space and society. Disaster safety education based on the community, such as community commitment, civic engagement, disaster management, and risk governance, can have different risks and resiliencies, depending on

the level of awareness of the region. To actively respond to a rapidly changing society and disasters, it is necessary to conduct research on education that can contribute to raising the level of awareness of residents and the development of disaster response capabilities of the community.

Second, it is necessary to conduct systematic research on disaster safety education as interdisciplinary research in the fields that have been independently studied. In particular, research on disaster safety education should be conducted from the perspective of lifelong education, because disaster safety education requires a learner's lifelong approach, and an understanding of the class is essential for the establishment and operation of education programs for the disaster-vulnerable group. Also, for lifelong education, the content of education is not limited, but covers various fields, such as language, culture, engineering, and technology. This is expected to be a key function for equipping communities with sustainable disaster response capabilities.

In some countries, including Korea, education for elderly people, disabled people, and multicultural families is being conducted, but the absence of specialized educational institutions has led to inadequate participation. Universities and research institutes related to lifelong education need to conduct research on education for these groups. In addition, it is necessary to analyze various cases of disasters by applying research methods in the field of lifelong education, such as narration and storytelling, and to establish a disaster occurrence scenario. This study can lay an academic framework by its undertaking of in-depth analysis of disaster risk management and risk in communities. In addition, interdisciplinary convergence research will contribute to establishing and operating regional customized educational scenarios and effective educational programs.

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