



Original paper

Integrated Disaster Risk Management in the Education Process in Schools

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Abstract Research in educational disaster mitigation has developed and is widely carried out, especially in schools. This research explores good practices based on the experience of teachers in Indonesia regarding the possibility of integrating DRR (Disaster Risk Reduction) education into the learning process in schools. This study used research and development (R and D) methods with the APPED model (preliminary analysis and research, design, production, evaluation and dissemination), which was carried out for two years. In particular, this paper reports the results of the first year's research with research activities including: (i) analysis and preliminary research and (ii) design. In the initial analysis and research stages, the research team carried out several activities, including analysis of material coverage, learning outcomes, and learning activities through literature review and document analysis, combined with case studies and FGD (Focus Group Discussion) involving 87 teachers in Yogyakarta, Malang, and Ciamis. Furthermore, the results of the activities in the second stage, (Design), are in the form of an analysis of the needs of students in DRR (Disaster Risk Reduction) education based on Ecosystem-based Disaster Risk Reduction (Eco-DRR). Studies reveal that DRR (Disaster Risk Reduction) education has the potential to be integrated into educational activities in schools. Practically, the main components of DRR (Disaster Risk Reduction) education include: coverage of materials, learning outcomes, and learning activities. The research results also show that the integrated interdisciplinary curriculum model has the potential to be adopted in the implementation of DRR (Disaster Risk Reduction) education, through intra-curricular, extra-curricular and co-curricular learning activities. This finding has implications for the need for teacher involvement in the next research stage, where production, evaluation, and dissemination processes are carried out. Good practices that have been carried out by teachers have become one of the important instruments in implementing integrated disaster risk management with the educational process in schools.

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Further, important to consider the integration of science and indigenous knowledge (ISIK) in implementing DRR education in schools, through intra-curricular, extra-curricular and co-curricular. The disaster and mitigation knowledge were empirical, genuine, participatory and interactive, within the localities context. Schools can be good agents for dissemination of the ISIK perspective in disaster and mitigation studies. Although the relation between scientific and indigenous knowledge is proposed by the participants, but theoretically and practically needed follow-up studies, especially to reduce the level of vulnerability.

Keywords: Disaster Risk Management, DRR Education (Disaster Risk Reduction), Eco-DRR (Ecosystem-based Disaster Risk Reduction), integrated interdisciplinary curriculum, integration of scientific and indigenous knowledge.

1. INTRODUCTION

Recent studies show that the frequency of natural disasters in the world has increased and has serious consequences for people around the world. There is strong evidence that natural disasters have serious consequences for people, property and the environment (Hamidzada & Cruz, 2019; Sun, Yamori, Kondo, 2014). Natural hazards cannot be avoided, but with precautions, the impact of hazards can be minimized. This is the reason why disaster education through curriculum interventions must integrate knowledge about local hazards to reduce risks so that loss and damage related to natural hazards can be reduced (Dwiningrum, Sumunar, & Sholikhah, 2020; 2021a). Teaching about hazards and disasters in class is a cost-effective method of reducing risk, and has long-term and far-reaching consequences (Nurdin, et al., 2017). Thus, optimizing DRR (Disaster Risk Reduction) education should be considered a high priority for the long-term goal. In line with that, UNISDR (2015) through the Sendai Framework for Disaster Risk Reduction 2015-2030 in addition to recommending the importance of managing systemic risk through an integrated and pluralistic approach to understand risk more comprehensively, also supports global promotion to integrate Disaster Risk Reduction (DRR) into formal education as one of the strategies to help increase knowledge and understanding of disaster risk in schools.

Indonesia has long experienced various threats and impacts due to natural disasters. Exposure to natural disasters carries a high risk and is exacerbated by the country's weak economy and political complexity; thereby making the Indonesian population more vulnerable to the adverse effects of natural disasters (Nurdin, et al., 2017). Geological hazards such as tsunamis, earthquakes and volcanic eruptions are the deadliest types of disasters in Indonesia. The importance of DRR (Disaster Risk Reduction) education in Indonesia is increasingly undeniable. High rates of poverty and population expansion, combined with the implications of climate change and rapid urbanization, present major challenges for disaster risk management in Indonesia (Kagawa and Selby, 2014). In the

education sector, natural disasters have made various contributions. It is estimated that three-quarters of all schools in Indonesia are located in disaster-prone areas, which consist of at least 40 million students. Most of the schools were built in the 1980s and did not take DRR into account, resulting in damage to school buildings and human casualties among children. This condition has a negative impact on the quality of education, especially when there are no plans for alternative school locations and students are refused school continuously. Likewise, psychosocial impacts occur when students lose their hope; depressed because their future is destroyed (Nurdin *et al.*, 2017; Suharwoto, 2015). Students can become one of the most vulnerable victims of a disaster if they are not adequately prepared with knowledge. Therefore, integrating DRR into the school curriculum can be one of the most effective methods for reducing the impact of disasters.

Implementation of DRR (Disaster Risk Reduction) in schools is closely related to various aspects of education, including aspects of curriculum, learning, school climate, school culture, leadership, school management, and synergistic relations with the community (Dwiningrum, Sumunar, & Sholikhah, 2020; 2021a). In order to increase the resilience of education units against disasters, the Ministry of Education and Culture has established the *Satuan Pendidikan Aman Bencana* (Disaster Safe Education Unit) or also known as *SPAB* program as an effort to prevent and manage the impact of disasters in educational units. The implementation of the program is regulated through Minister of Education and Culture Regulation Number 33 of 2019 concerning Implementation of the Disaster Safe Education Unit Program. In the Permendikbud, the implementation of the Disaster Safe Education Unit program is carried out during normal or pre-disaster situations, in emergency situations, and after disasters.

Disaster mitigation education or in other terms it is also often referred to as Disaster Risk Reduction and Prevention (DRR) Education is an interactive learning process in the midst of the community and existing institutions (Suharwoto, 2015; Dwiningrum, Sumunar, & Sholikhah, 2020; 2021a). The scope of DRR education is wider than formal education at schools and universities. This includes the recognition and use of traditional wisdom and local knowledge for protection against natural disasters. In addition, DRR Education is a very important vehicle for creating a culture of being ready and alert in facing the threat of a disaster.

2. DISASTER RISK MANAGEMENT

2.1 The Evolution of Disaster Risk Management

The increasing concern about the impact of disasters, initiated the UN General Assembly to declare the International Decade for Natural Disaster Reduction (IDNDR) 1990-1999. The International Decade for Natural Disaster Reduction (IDNDR) then organized the World Conference on Natural Disaster Reduction in Yokohama in 1994. This conference compiled

the Yokohama Strategy and Plan of Action for a Safer World which emphasizes that every country has the primary responsibility to protect its people, infrastructure and national, social and economic and ecological assets from the effects of natural disasters. The Yokohama Strategy and Plan of Action for a Safer World emphasizes the urgent need to move from a primarily reactive approach to disaster mitigation to a new paradigm based on a more comprehensive approach that includes preventive action, primarily aimed at reducing the likelihood that natural hazards is translated into a disaster (IDNDR, 1994). Disaster risk management seeks to address underlying social, economic and environmental vulnerabilities and thereby reduce the likelihood of a disaster occurring. In an ideal world, preventive measures would render efforts to organize disaster relief 'obsolete', but realistically they could minimize the impact of disasters, both human-related and economic costs due to natural hazards (Sperling & Szekely, 2005). Disaster risk management tries to address hazard risks as an integral part of development. As a result, fewer events and more focus on process. It is based on an ongoing assessment of vulnerabilities and risks involving multiple actors and stakeholders, such as governments, technical experts and local communities (UNISDR, 2004).

Ideally disaster risk management would require a comprehensive multi-hazard focus, which includes simultaneous consideration of the different types of geological and/or hydro-meteorological hazards to which a given country or region is exposed. At the country level, it would be ideal to account for the probabilistic occurrence of all these events in economic planning. Preventive measures within a given area must, of course, focus on local hazards and address known vulnerabilities. Disaster prevention and contingency plans can be built based on past experience and scientific knowledge about exposure to certain types of hazards and their frequency of occurrence (Dwiningrum, Pratiwi, Sumunar, 2022). For example, geological hazards are often localized (*e.g.*, volcanic eruptions and earthquakes along zones of tectonic activity) and follow large-scale time variations. The Indonesian Disaster Risk Index (*Indeks Risiko Bencana Indonesia, IRBI*) published by the National Disaster Management Agency (*Badan Nasional Penanggulangan Bencana, BNPB*) aims to provide information on the level of disaster risk for each district/city in Indonesia (Adi, et al., 2022, Wiguna, et al., 2021, 2020). The calculation of the level of risk in each district/city is carried out by taking into account the hazard, vulnerability and capacity factors. Next, the level of disaster risk in districts and cities is presented according to the hazards they have and the combination of these hazards. Thus, this Disaster Risk Index is an assessment of all districts/cities in Indonesia based on existing disaster risks. The data used is data from risk assessment consisting of: (1) hazard per type of disaster, (2) exposed lives per type of disaster, (3) loss of rupiah per type of disaster, (4) environmental damage (ha) per type of disaster and (5) local government capacity per district/city.

2.2 Disaster Risk Management Through Disaster Mitigation Education

Implementation of Disaster Risk Reduction (DRR) in schools is closely related to various aspects of education, including aspects of curriculum, learning, school climate/culture, leadership and school management, and synergistic relations with the community. In

Indonesia, there are 497,576 education units in 34 provinces where around 70% or 250 thousand schools are located in disaster-prone locations (Amri, 2017). Of these, until 2018, 25,920 or 10% of the total number of schools in disaster-prone areas had implemented disaster education by various actors. One of the things done in disaster education is through the formation of disaster safe *schools/madrasas (SMAB)* or now better known as the Disaster Safe Education Unit (SPAB) (Koswara, 2019). This establishment provides a positive response to disaster education which requires massive and continuous implementation.

The impact of the disaster on the education sector resulted in many casualties for students and teaching staff, cessation of the teaching and learning process, damage to school facilities and infrastructure and loss of school documents. It is hoped that the teaching and learning process will continue under any circumstances and that school members will have the ability and readiness to face disasters at school. For this reason, the Disaster Safe Education Unit Program is important to implement in order to foster a culture of disaster awareness (Sudiartha, 2019). Implementation of DRR education in formal education can be pursued through two channels, namely: (a) adding DRR subjects to the formal curriculum; (b) adding to the hidden curriculum or informal curriculum (Dwiningrum, Sumunar, & Sholikhah, 2021b).

DRR curriculum formulation is a series of formulations that have been adapted to the needs of schools and regions. This formulation has been corroborated by the Education Office's decision or the school's and committee's decisions. The implementation of this curriculum is based on the agreement and ability of the schools and regions that will fund it. DRR subjects can be implemented through Local Content in the form of a formal curriculum, namely mandatory local content and optional local content. Compulsory local content is a subject that must be taken by students in classes that can be designed on the basis of: (i) the form of the curriculum, and (ii) the dimensions of assignments and materials. Furthermore, Dwiningrum, Sumunar, & Sholikhah (2021b) explained that the development of Disaster Mitigation Education materials can be carried out with various strategies according to the curriculum determined by the school, namely:

a) Single Subject Matter (*Kurikulum Mandiri*)

The principle of single subject DRR is that the curriculum is conducted in the form of subjects and adapted to the particularities of a school. The single subject curriculum can be implemented easily because the contents of the material presented are local content and separated (separated curriculum). This independent curriculum is adaptive so that it can be combined with a broad-based curriculum model, namely the materials and subject matter are adapted to more current development situations. Implementation of an independent DRR curriculum has the aim of developing students' thinking skills and a sense of sensitivity towards developments in the situation in society. The pattern that can be used to implement DRR education is the obligatory local content model, however some schools combine compulsory local

content with selected local content by developing Competency Standards (*Standar Kompetensi*), Basic Competency (*Kompetensi Dasar*), and Competency Achievement Indicators. The duties and authorities of the education unit and school committee are to develop local content subjects. The local content that is developed is the background, objectives, scope, competency standards, basic competencies, and direction of subject development.

b) Integrated Subject (*Kurikulum Terpadu*)

The integrated curriculum is a curriculum that is carried out openly and formally, but can also be implemented in a closed manner. The curriculum is carried out openly by bringing together several themes or topics, while the closed curriculum is carried out by delivering material in the form of social norms or principles and providing an understanding of local values. Local values are exemplified in the rules, norms and rules of learning. Norms and values are taught through the example of teachers, stories, or the application of discipline, there are rules for learning from each teacher. This curriculum can be implemented with the integration of various subjects that have the same theme, for example, science and Indonesian in elementary schools, the theme taken is flood hazard. Science subjects will focus on discussing the causes of flooding and rescue steps that must be carried out by everyone. Then, Indonesian language subjects can teach students to compose poetry with the theme of flooding.

2.3 Eco-DRR (Ecosystem-based Disaster Risk Reduction) Approach

In practice, disaster risk reduction efforts can be carried out through Ecosystem-based Disaster Risk Reduction (Eco-DRR), an ecosystem-based disaster risk reduction approach that is inclusive, involves community participation, and is cost-effective, socially friendly, and sustainable (Dissanayaka, Tanaka, Vinodh, 2022; Quevedo, Uchiyama, Kohsaka, 2020). Eco-DRR as a series of risk management has the dimensions of hazard reduction, vulnerability reduction and exposure reduction (UNDRR, 2020). In the context of this research, Eco-DRR is used as a strategic instrument to understand disasters and the environment as a holistic whole (Valenzuela, et al., 2020) – which is relevant to the go green movement in educational institutions – because the process involves affective, cognitive, and psychomotor.

Currently, education units have integrated disaster safety education or disaster mitigation education into their curriculum using the Eco-DRR approach through the Adiwiyata School (Dwiningrum, Pratiwi, Sumunar, 2022). For example, Banguntapan 2 Public High School has an integrated mangrove planting program through co-curriculars and extracurriculars, where students are invited to actively participate from the preparation, implementation, to evaluation and follow-up plans. Mangrove planting was carried out at Baros Beach, Bantul,

Special Region of Yogyakarta, Indonesia. The mangrove tree planting program is intended as an effort to restore marine ecosystems, restore and enhance protective functions, as well as implementation of disaster risk reduction (eco-DRR) through the Adiwiyata School program. The mangrove planting activity was chosen by the school as an important part of implementing Eco-DRR because it involves the participation of the school community (students and teachers), is cost-effective, socially friendly, and sustainable. The role of schools in developing disaster risk reduction knowledge is important to do at all level of education, including in terms of disaster risk management. The research results of Dwiningrum, Sumunar, & Sholikhah, (2021a, 2021b) found that in terms of disaster risk management, schools have the strengths and abilities to: (i) detect disaster risk, (ii) understand vulnerability, and (iii) carry out an assessment of possible impacts disaster. In practice, these three elements can be integrated into several subjects and can also be applied gradually and continuously in the learning process in schools so that a culture of disaster awareness is formed. These learning abilities are an important part of the process of establishing a disaster-aware school culture.

3. METHODOLOGY

This research was developed through literature review and document analysis, combined with case studies and FGD (Focus Group Discussion). Document analysis was carried out through a systematic review of Basic Competency (*Kompetensi Dasar*) provided by the Indonesian National Curriculum Center to see whether disaster knowledge has been included in the current curriculum, especially the new 2013 curriculum (Ministry of Education, 2013), because it is a mandatory standard of teaching- learning in Indonesia. This section will attempt to understand how far DRR has been integrated into syllabuses in Indonesian schools.

In addition, this research also adopts a case study approach for certain subjects, namely Geography and Sociology at the Senior High School level, where DRR education based on the Ecosystem-based Disaster Risk Reduction (Eco-DRR) approach has great opportunities to be explored, especially in terms of material coverage, learning outcomes, and learning activities. Finally, the research team used FGD (Focus Group Discussion) to collect data on the implementation of DRR education based on the Ecosystem-based Disaster Risk Reduction (Eco-DRR) approach in the area. This session involved 87 teachers in Yogyakarta, Malang, and Ciamis. This FGD (Focus Group Discussion) contributed ideas regarding how DRR could be integrated into teaching Geography and Sociology in Senior High Schools and what obstacles would arise in its implementation. The questions asked to them were structured in such a way as to allow them to express themselves by giving more than one answer, thereby broadening the discussion. Participants also provided several recommendations regarding the key issues raised during the FGD to be integrated into the scope of material, learning outcomes, and learning activities. All forms of activity during the FGD (Focus Group Discussion) have been recorded during the session.

4. RESULTS AND DISCUSSION

4.1 Results

This section presents potential content for integrating DRR (Disaster Risk Reduction) into the school curriculum as stated in the national standard curriculum. The description includes identification and exploration of the scope of material, learning outcomes, and learning activities for ecosystem-based DRR (Disaster Risk Reduction) Education, or what is known as Eco-DRR (Ecosystem-based Disaster Risk Reduction), in Geography and Sociology in Senior High School. During the FGD, participants were asked to brainstorm related: (i) scope of teaching materials, (ii) learning outcomes, and (iii) learning activities for DRR Education (Disaster Risk Reduction).

During the FGD (Focus Group Discussion) process several activities were carried out by the participants, including:

- a) Participants were divided into small groups, according to the subject being taught, namely the Sociology Group and the Geography Group.



Figure 1: Small Group Discussion Process (Source: Research Team Documentation, 2022)

b) The discussion process begins with brainstorming or brainstorming. To visualize the participants' ideas or ideas, they present them in the form of schematics, tables or pictures on large manila flipcharts measuring 85x60 cm.

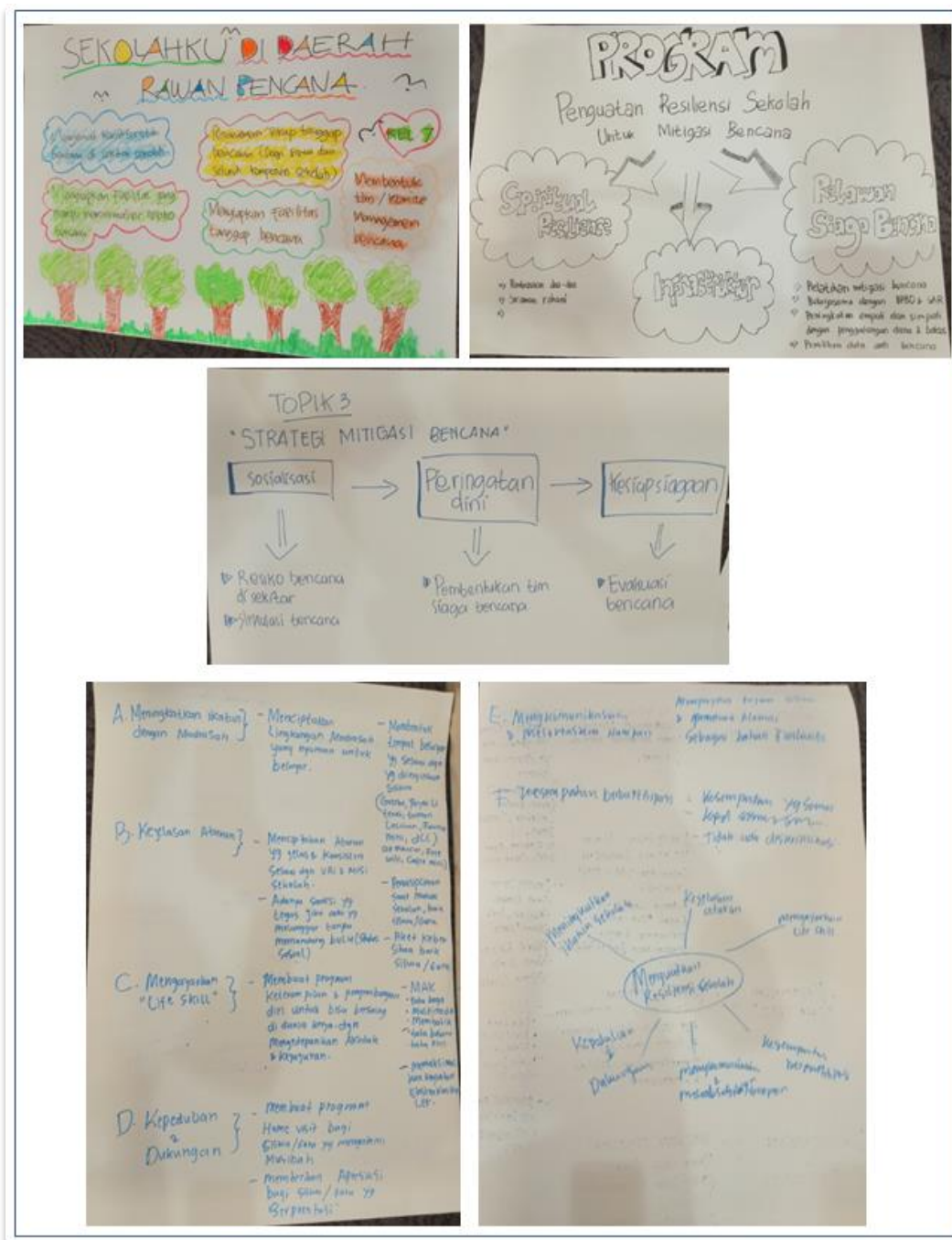


Figure 2: Small Group Discussion Results (Source: Research Team Documentation, 2022)

c) After the discussion conclusions were obtained, representatives of each group presented the results of the group's work in the forum to obtain responses, comments, or other clarifications from all FGD (Focus Group Discussion) participants.



Figure 3: Small Group Discussion Results (Source: Research Team Documentation, 2022)

- d) In the final session of the FGD (Focus Group Discussion), each participant was requested to provide input, comments, suggestions, and other matters related to the draft content (material) through the Google Form which had been prepared by the research team.

- e) After the FGD (Focus Group Discussion) took place, the research team asked and explored good practices based on the experiences of teachers in Yogyakarta, Malang and Ciamis regarding the possibility of integrating disaster mitigation education into the learning process in schools.

After the data from the FGD (Focus Group Discussion) and the results of interviews about good practices (case studies) in several schools participating in the FGD were collected, the research team then conducted an initial analysis of primary data sources to obtain more detailed information regarding: (i) the scope of teaching materials, (ii) learning outcomes, and (iii) learning activities for DRR Education (Disaster Risk Reduction) required. The results of the literature review and FGD activities are maps of analysis of teaching materials, learning outcomes, and student learning activities which are specifically presented in the form of learning designs as shown in the image below.

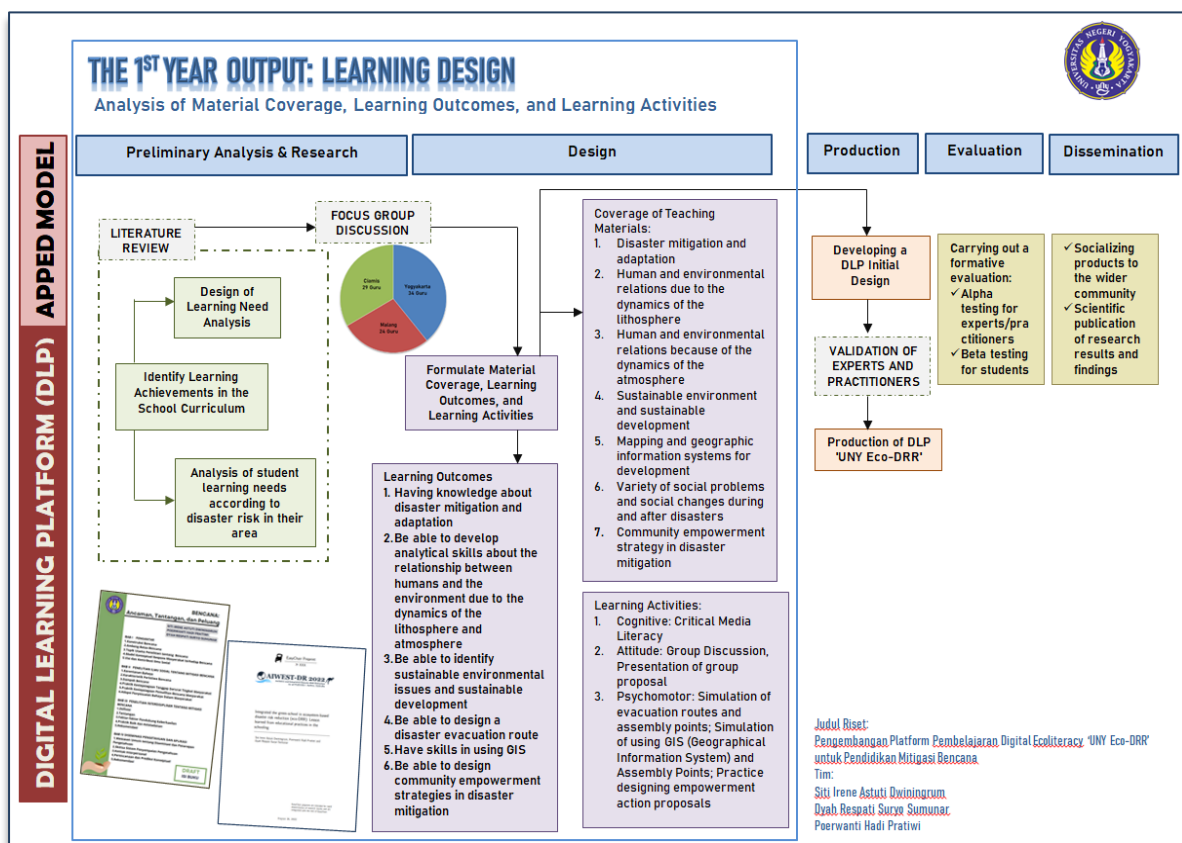


Figure 4: APPED Model Stage-Based Learning Design

4.2 Discussion

This study investigates the possibility of integrating ecosystem-based DRR (Disaster Risk Reduction) Education, or what is known as Eco-DRR (Ecosystem-based Disaster Risk Reduction), in the learning process in Senior High Schools. Identification and exploration are carried out to find out how good practices based on teacher experience contribute to the design of learning designs for DRR (Disaster Risk Reduction) Education. The discussion

process that begins with brainstorming or brainstorming clearly describes the knowledge and experience that the teacher has. Visualization of participants' ideas or ideas presented in the form of schematics, tables or pictures on large manila flipcharts represents opportunities for DRR Education (Disaster Risk Reduction) to be integrated into the learning process in schools.

The findings of the FGD (Focus Group Discussion) revealed that the research team and participants had succeeded in identifying and exploring strategies for integrating DRR Education (Disaster Risk Reduction) into the school curriculum. The Forum suggested that integration needs to be carried out into three aspects of learning design: analysis of content coverage, learning outcomes, and learning activities. Table 1 shows the themes and sub-themes resulting from the FGD (Focus Group Discussion); which in the subsequent research process is very likely to be developed further into the development of a DRR (Disaster Risk Reduction) Education curriculum.

DRR (Disaster Risk Reduction) Education Curriculum Model

The idea of developing an integrated DRR (Disaster Risk Reduction) Education curriculum model was carried out by bringing together several themes or topics. This model curriculum can be implemented with the integration of various subjects that have the same focus to complement each other, for example, Geography and Sociology in Senior High School. The focus of DRR Education (Disaster Risk Reduction) in the form of: disaster mitigation, environmental management, and community-based empowerment can be studied and/or strengthened through Geography and Sociology subjects. An integrated interdisciplinary curriculum is carried out by combining the basic competencies of several subjects that are interrelated with each other to avoid overlapping and maintain suitability in learning. Integration is carried out without including multidisciplinary basic competencies for each subject so that each subject still has the correct basic competencies. Integrated trans-discipline is carried out by connecting various subjects with the problems faced around them so that the learning process becomes contextual. Themes are connecting various basic concepts so that students will not learn the basic concepts partially. Thus, learning gives full meaning to a student which is reflected in the various themes available.

Referring to several literature reviews related to the interdisciplinary curriculum model, Jacobs (1989) provides several observations he has made over the past 15 years, that learning with an interdisciplinary model often lacks endurance. Two problems in selecting content that often interfere with the learning process, namely: *First*, The Potpourri Problem. Many units are examples of knowledge from each discipline. If the subject is Ancient Egypt, then there will be a little history of Ancient Egypt, a little literature, a little art, and so on. Some experts criticize this approach for a lack of focus.

Table 1: FGD Results DRR Education Themes and Sub-themes (Disaster Risk Reduction)

No.	Theme	Sub-Theme	Details
1.	DRR (Disaster Risk Reduction) Education Curriculum Model	a. Integrated Curriculum	The focus of DRR in the form of: disaster mitigation, environmental management, and community-based empowerment can be studied and/or strengthened through Geography and Sociology subjects
		b. Social Science Cluster: Geography and Sociology	
		c. Coverage of Teaching Materials	Eco-DRR chapters/topics include: <ul style="list-style-type: none"> • Disaster mitigation and adaptation • Human and environmental relations due to the dynamics of the lithosphere • Human and environmental relations because of the dynamics of the atmosphere • Sustainable environment and sustainable development • Mapping and geographic information systems for development • Variety of social problems and social changes during and after disasters • Community empowerment strategy in disaster mitigation
2.	Learning Outcomes for DRR (Disaster Risk Reduction) Education	Integrated in the PjBL (Project-based Learning) learning model	<ul style="list-style-type: none"> • Have local knowledge about disaster mitigation and adaptation • Develop analytical skills about the relationship between humans and the environment due to the dynamics of the lithosphere and atmosphere • Identify sustainable environmental issues and sustainable development • Using geographic information systems and mapping for development in local area • Designing local community empowerment strategies in disaster mitigation
3.	Learning Activities for DRR Education (Disaster Risk Reduction)	• Cognitive	Critical Media Literacy
		• Attitude	<ul style="list-style-type: none"> • Group Discussion • Presentation of group proposal
		• Psychomotor	<ul style="list-style-type: none"> • Simulation of evacuation routes and assembly points • Simulation of using GIS (Geographical Information System) and Assembly Points • Practice designing empowerment action proposals

In contrast to the disciplines which have inherent scope and sequence used by curriculum planners, there is no general structure of interdisciplinary work. Curriculum developers themselves must design the scope and sequencing of content for each interdisciplinary unit or course. *Second*, The Polarity Problem. Traditionally, interdisciplinarity and disciplinary (scholarship) fields have been seen as one/or polarity, which has driven a series of conflicts. Curriculum design not only offers a fortune of clarity, but real tensions can arise between teachers. Some feel very 'powerful' about their subject and are threatened when new views on their subject are promoted. There is a need for interdisciplinary perspectives and disciplinary

(scientific) fields in determining curriculum designs and/or models. To avoid these two problems, Jacobs (1989) further suggests that an effective interdisciplinary program must fulfill two criteria: (i) an interdisciplinary curriculum must have carefully understood design features: scope and sequence, cognitive taxonomy to encourage thinking skills, attitude change behavior indicators, and a solid evaluation scheme; and (ii) the interdisciplinary curriculum must use disciplinary-based (scientific) and interdisciplinary experiences for students in the curriculum.

Learning Outcomes for DRR (Disaster Risk Reduction) Education

Learning outcomes must be oriented towards forming knowledge, psychomotor (creativity), and attitudes that must be achieved by students to fulfill certain basic competencies. Learning outcomes that refer to an interdisciplinary curriculum must be balanced between two disciplines (for example, Geography and Sociology), as explained in Table 1. In this process, a series of cross-disciplinary activities to be developed must be arranged and connected by themes and activities, to form integrated learning continuum (Lonning, DeFranco, Weinland, 2010). The next step in this process is to assess the level of integration between two or more disciplines in each activity, as previously described. The activity refinement process involved a team of teachers/writers discussing each activity from each discipline and assessing each new activity against a continuum. As previously explained, the aim of this process is to improve the balance of integrated activities whenever possible.

In practice, DRR Education (Disaster Risk Reduction) is integrated into curricular programs that have been implemented (Triastari, Dwiningrum, Rahmia, 2021; Pambudi, 2018). It is hoped that each curricular program will incorporate DRR (Disaster Risk Reduction) values into its implementation, be it intra-curricular, co-curricular or extra-curricular. This model can be implemented if teachers and school principals have the readiness and ability to be creative, have initiative, and have lots of ideas related to DRR so that they can deal with the curriculum intelligently and deftly and can manage learning and develop assessments. The implementation of this model provides the advantage of being cost-effective and does not add to the school's burden (Dwiningrum, Sumunar, & Sholikhah, 2021b).

Learning Activities for DRR Education (Disaster Risk Reduction)

It has been explained previously that the interdisciplinary curriculum development model is used to clarify theme-based, interdisciplinary and integrated learning activities. In practice, the integration continuum model is used to facilitate the refinement of activities included in theme-based instruction. Learning activities are designed in two phases: the theming phase and the activity refinement phase (Lonning, DeFranco, Weinland, 2010). A theme is a topic, concept, problem or issue that provides both a focus and a framework to guide the development and delivery of a cohesive and interrelated series of lessons or activities. Interdisciplinary refers to a knowledge view and curriculum approach that consciously applies the methodology and language of more than one discipline to examine a central theme,

issue, problem, topic, or experience (Jacobs, 1989). Integrated is used to describe the nature of the relationship between two or more disciplines that are included in one interdisciplinary unit. The concept of integration becomes very important at a certain level of learning activity. Visualization of the continuum integration of concepts/activities in geography and sociology based on learning activities for DRR Education (Disaster Risk Reduction) is shown in Figure 5 below.

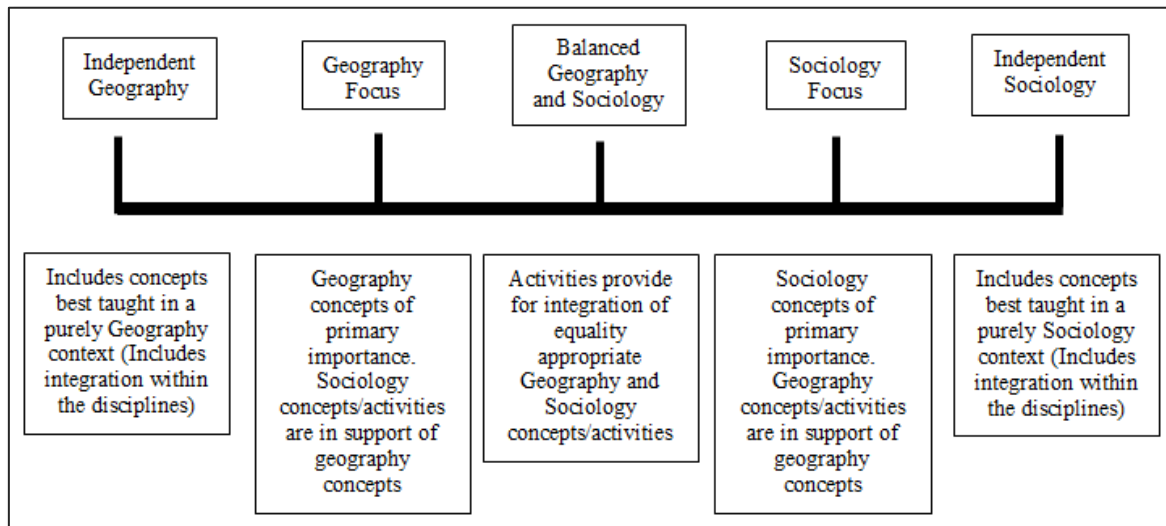


Figure 5: Continuum of integration of Geography and Sociology concepts/activities

The integration continuum of Geography and Sociology concepts/activities as shown in Figure 5, is intended to assist in the process of developing DRR Education (Disaster Risk Reduction) which is integrated into the curricular program. The integration continuum is seen as a set of guidelines to help monitor and guide the 'process' and not as a prescriptive list of rules or procedures to be followed rigidly. In addition, it is assumed that teams of teachers with expertise in their respective disciplines (Geography and Sociology) work together during the DRR Education (Disaster Risk Reduction) process. The integration continuum involving learning perspectives and theories will lead to conceptualization of how students learn to be prepared and resilient, which in turn is also beneficial for disaster risk management planning. Experts recommend a variety of educational approaches and/or methods that can be adopted to design learning activities that can realize DRR (Disaster Risk Reduction) Education. Social learning and collaborative action plans are promising approaches (Kitagawa, 2021; Dufty, 2018; Samaddar, et al., 2015) for adoption. Social learning theory is a theory of social learning and behavior that proposes that new behaviors can be acquired by observing and imitating others (Bandura, 2007), while promoting the importance of people learning together. With reference to the definitions and frameworks currently being developed in the field of disaster risk management, it is important that educational programs aimed at building community disaster resilience are always discussed and evaluated so that they can make a real contribution to DRR (Disaster Risk Reduction).

Considering the ISIK Perspective in DRR Education: A Proposal

The role of schools to develop disaster risk management knowledge is important at all levels of education (Dwiningrum, Sumunar, Sholikhah, 2021a; 2021b) found that in terms of the disaster risk management, schools have the power and ability to: detect disaster risk, understand vulnerabilities, and conduct disaster impact assessments. The teachers' communities selected for the study, due to their geographical location and kinds of natural hazards, suggested to prioritize what to teach, how to visualize it, and how to the rescue simulation in a disaster situation. In particular, this research also found that the awareness, sensitivity, and concern of school residents in building and maintaining a resilient sustainable environment through an eco-DRR approach is self-actualization and local community from the disaster experiences they experienced as a person living in Yogyakarta, Malang, and Ciamis. The teacher FG participants said that knowledge about disaster is empirical, and it's obtained from direct observation and experience. The disaster experiences experienced and owned by teachers and students can be a contextual learning resource and can be systematized and/or integrated with eco-DRR in the school curriculum in Indonesia. This study confirmed the findings of previous studies (Quevedo, Uchima, Kohsaka, 2020; Wang, et al., 2019; Dufty, 2018; Nurdin, et al., 2017; Sun, Yamori, Kondo, 2014; Baumwoll, 2008) that school can play a very important role to dissemination of the disaster and mitigation knowledge in local area. In most participants revealed that to construct and develop a local disaster education plan, with each program consisting of several teaching materials, learning outcomes, and student learning activities (as shown in Table 1) should be linked to or be a sub-set of local disaster management plans. Such as incorporating local knowledge and local community empowerment strategies in disaster mitigation and adaptation into DRR policies, specifically in education, is another way to reduce a community's vulnerability to natural hazards, thus leading to a reduction in disaster risk.

In particular, the final section of this paper proposed the importance of ISIK (Integration of Scientific and Indigenous Knowledge) perspective to consider in disaster risk management studies, especially in educational processes. Today, global policies stress the need of the ISIK perspective integrating to the EWS (Early Warning Systems) framework (Hermans, et al., 2022; Vasileiou, Barnett, Fraser, 2022; Pandey & Basnet, 2022). Overall, we found that the teacher FG participants compile of disaster experiences that contribute to disaster knowledge as a mechanism that can be used to plan priority actions that are integrated into the school curriculum. Bridging indigenous and scientific knowledge in learning processes seem from the local disaster education plan as outcome from the FGD results. The following bullet points highlight of the ISIK perspective's in DRR education refers to research findings:

- a) Teaching materials, e.g.: (i) The 'wisdom of *Smong*' (song and lullabies) as the musical DRR strategy from earthquake and tsunami in Simeulue Island (Aceh); (ii) '*Ami Norang*' (people screaming as the early warning system to earthquake) in Tana Ai (East Nusa Tenggara); (iii) '*Teteu Amusiast Loga*' (a song that is sung when the squirrel has screamed, as the first signal that earthquake will come in) in

Mentawai Island (West Sumatra); (iv) 'Subak' (Bali traditional water management system/irrigation), as local knowledge/local genius/local wisdom in Bali to prevent floods and landslides.

- b) Student learning activities, *e.g.*: (i) using geographic information systems (GIS) and mapping for development in local area, (ii) designing of evacuation routes and assembly points using MATLAB, (iii) virtual disaster mitigation simulation, (iv) designing local community empowerment strategies in disaster mitigation, and (v) practice designing empowerment action proposals.

5. CONCLUSION

Indonesia's geographical condition is located on the Pacific ring of fire, making Indonesia a country that has the most active volcanoes and also a high potential for natural disasters. Indonesia is crossed by the Indo-Australian plate to the south, the Pacific from the east and the Eurasia from the north, which positions Indonesia as a disaster-prone country both from tectonic and volcanic activity. For this reason, the Indonesian government is obliged to carry out disaster management, in order to avoid the occurrence of many casualties, one of which is risk management. Based on the research findings and discussions that have been presented, it can be concluded that disaster risk management through the education sector can be carried out by integrating DRR (Disaster Risk Reduction) education into the learning process in schools. Firstly, the strategy that can be implemented to integrate DRR (Disaster Risk Reduction) Education into the school curriculum is to identify and explore Ecosystem-based Disaster Risk Reduction (Eco-DRR) learning designs. In the early stages of this research, it has succeeded in formulating an analysis of the scope of material, learning outcomes, and learning activities. Secondly, the series of DRR (Disaster Risk Reduction) Education processes as part of a disaster risk management approach are aimed at integrating the spirit of DRR (Disaster Risk Reduction) among the younger generation. There is an urgent need to prepare young people to be ready and resilient to disasters, enabling schools to adopt social learning and collaborative action plans in implementing DRR (Disaster Risk Reduction) education, especially at the local level. Thirdly, the possibilities to adopt the ISIK (Integration of Scientific and Indigenous Knowledge)'s perspective in DRR education. Different social degrees of community and application of knowledge for community-based disaster risk reduction are considered as important in this research. Therefore, based on proposed framework, this study also considers the theoretical framework to integrate these two vital factors together. Further research should include the analysis of the ISIK opportunities in educational sector, as well as to understand if the knowledge and information gained and observed during this study will continue in the long run, especially in school as part of local communities.

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