



## Integrated the Green-School in Ecosystem-Based Disaster Risk Reduction (Eco-DRR): Lesson Learned from Educational Practices in the Schooling

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# Integrating Green Schools in Ecosystem-based Risk Reduction (Eco-DRR): Lessons from Educational Practices in Schools

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**Abstract.** This study observes the implementation of Eco-DRR in Indonesia. In the last decade, education programs related to Eco-DRR have been promoted through green schools or 'Adiwiyata' schools. The research priority focuses on exploring student learning activities to map and describe the extent to which The Sendai Framework is implemented at the local level, especially in schools. This research is located in SMA Negeri 2 Banguntapan, Yogyakarta, Indonesia; which programmatically has an agenda to invite and involve students in conservation and restoration activities as an important part of implementing Eco-DRR. Data was collected through interviews, document analysis, and observation. Data was analyzed through qualitative method. The study revealed that the disaster experiences experienced by teachers have increased their knowledge, sensitivity, and awareness of Eco-DRR. The theme in Science cluster: climate change, viruses, and ecological balance. The theme in Social Studies cluster: natural disaster mitigation and adaptation, environment and sustainable development, mapping and geographic information systems for development, social change during and after disasters, community empowerment strategies in disaster mitigation, local wisdom in disaster mitigation. The Language cluster guides students' skills for effective reading, writing and speaking about climate change, environmental conservation, and disaster mitigation. To enable a more holistic and sustainable management of Eco-DRR, this study recommends the need for policymakers to listen to, assess, and respect the 'voice' of students in their efforts to prepare for risk reduction as early as possible.

**Keywords:** Ecosystem-based Risk Reduction (Eco-DRR), Educational practices, the Green School, Engaging youth in DRR

## 1 Introduction

Indonesia has a high risk of hydro meteorological disasters as a consequence of its geographical and geological location. On the other hand, the phenomenon of climate change also contributes to the increase in hydro meteorological disasters [1][2]. Alt-

though nationally the average disaster risk index in 2019 in all provinces decreased by 7.93%, or from 156.43 to 144.02 [3]; however, 19 provinces are in the high disaster risk cluster, 15 provinces are in the moderate cluster, and no province is in the low cluster. Increased risk does not only occur in Indonesia, but globally [1][2], as a result of environmental degradation due to increased human activities. For this reason, UNDRR [2] recommends the importance of handling systemic risk through an integrated and pluralistic approach to understand risk more comprehensively [3][4][5].

Indonesia already has Law no. 24/2007 concerning Disaster Management and the Master Plan for Disaster Management for 2020-2044 in the Presidential Regulation of the Republic of Indonesia Number 87/2020. In certain aspects, Indonesia's regulations have referred to the Sendai Framework for Disaster Risk Reduction 2015-2030 [6]. For example, BNPB (National Agency for Disaster Management) stated that Indonesia had shifted its focus from emergency response after a disaster occurred to a more comprehensive and preventive approach to DRR. The implication is that Indonesia is moving gradually from a score of 3.0 to 3.7 in implementing the Hyogo Framework for Action (HFA) Priority during the 2013-2015 periods [7]. Indonesia's progress rate is slightly higher than other countries [8]. However, in other aspects, efforts to reduce disaster risk are still not fully maximized, especially in terms of: investment priorities, availability of access to comprehensive disaster and risk information [9] – especially in the field of education which is one of the keys to the success of DRR at the local level [10][2][11]. For this reason, inter-ministerial cooperation was carried out. For example, the Ministry of Environment and Forestry has the Adiwiyata School program, which is strengthened by the Strengthening Character Education program from the Ministry of Education and Culture of the Republic of Indonesia [12]. In practice, disaster risk reduction efforts can be carried out through Ecosystem-based Disaster Risk Reduction (Eco-DRR) [13][14], an ecosystem-based disaster risk reduction approach that is inclusive, involves community participation, is cost-effective, socially friendly and sustainable. Eco-DRR as a series of risk management has the dimensions of hazard reduction, vulnerability reduction, and exposure reduction [15]. In the context of this research, Eco-DRR is used as a strategic instrument to understand disasters and the environment as a holistic unit [20] – which is relevant to the go green movement in educational institutions – because the process involves affective, cognitive, and psychomotor dimensions. Currently, education units that integrate disaster safety education or disaster mitigation education in their curriculum are common. However, how the implementation of disaster mitigation education is contextualized in Eco-DRR through the 'Adiwiyata' School is still very limited.

This study examines and explores various learning activities designed by Adiwiyata School (the green-school) to implement The Sendai Framework – Priority 1: 'understanding disaster risk' at the local level, especially in schools. Forms of resource use and efforts made by schools to raise environmental awareness in order to support ecosystem sustainability are identified and explored. This is intended to ensure that Eco-DRR has indeed been integrated and implemented in Adiwiyata Schools. The main question addressed in this study is about the lessons that could be taken from disasters in Yogyakarta and other parts of Indonesia, so it can be managed and used effectively to improve understanding of disaster risk for students (adolescents). Over-

all, this study aims to provide insight and information on educational practices carried out by the school community in decision-making and making program of learning activities, as well as the roles they can play in managing the Adiwiyata School which has an Eco-DRR perspective. A literature study focusing on knowledge management for disaster risk reduction is proposed to provide a basic understanding of the elements of knowledge management needed to support the integration of Eco-DRR in schools through the Adiwiyata School program. This is followed by a compilation 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.

## **2 From Disaster Experience to Disaster Knowledge**

### **2.1 Ecosystem Knowledge Management for Disaster Risk Reduction**

In many places around the world, disaster risk is increasing due to unplanned socio-economic development in locations remote from exposure to various hazards. Unexpected hydro meteorological hazards are increasing in frequency, along with global climate change [1][2]. Likewise with infrastructure projects such as dams and embankments that trigger floods, droughts, and other hazards; combined with rapid economic growth, largely unplanned urbanization in coastal areas and open rivers, has resulted in the loss of living ecosystems [15][16]. The Global Risks Report 2020 [17] places issues related to global warming, such as extreme weather and loss of biodiversity, as the top five risks over the coming decades. These interacting processes pose complex challenges and systemic risks to human security and ecosystem well-being. Therefore, there is an urgent need for countries to better understand the impacts and associated risks of ecosystem degradation and to integrate conservation and rehabilitation of ecosystems, as well as sustainable management of natural resources in national DRR (Disaster Risk Reduction) policies and plans.

A degraded environment is the main trigger of the emergence of disaster risk. For example, lack of good vegetation cover on slopes can result in landslides under heavy rainfall. In addition, the absence of ecosystem restoration efforts exacerbated the impact of the disaster and also affected the recovery of post-disaster livelihoods. If the urban master plan does not safeguard these natural elements through comprehensive sustainable planning, then rapid urbanization will further exacerbate and have negative impacts on local urban (urban) and peri-urban ecosystems. On the other hand, disasters also impact ecosystems, causing environmental damage and loss which in turn increases risks. Recognizing the interdependence between human well-being, ecosystems, and changing risk patterns, NbS (Nature-based Solutions) such as conservation, restoration, sustainable use and management of natural resources, are an integral part of DRR (Disaster Risk Reduction). In this context, Eco-DRR offers many benefits, including DRR, and systemic opportunities for sustainable development. Eco-DRR utilizes ecosystems to prevent, mitigate or buffer, natural hazards and climate change impacts – either as an option or to support built infrastructure [15]. However, not all hazards can be effectively mitigated by ecosystems, for example in the case of earthquakes and tsunamis, where coastal forests provide only limited pro-

tection [18]. Table 1 below shows that different types of ecosystems have different hazard reduction functions.

**Table 1.** Hazard mitigation functions of different ecosystems.

Ecosystems	Hazard Mitigation	
<b>Mountain forests, vegetation on hillsides</b>	<ul style="list-style-type: none"> <li>➤ Vegetation cover and root structures protect against erosion and increase slope stability by binding soil together, preventing landslides</li> <li>➤ Forests protect against rockfall and stabilise snow, reducing the risk of avalanches</li> </ul>	<ul style="list-style-type: none"> <li>➤ Catchment forests, especially primary forests, reduce risk of floods by increasing infiltration of rainfall, and delaying peak floodwater flows, except when soils are fully saturated</li> <li>➤ Forests in watersheds are important for water recharge and purification, drought mitigation and safeguarding drinking water supply</li> </ul>
<b>Wetlands, floodplains</b>	<ul style="list-style-type: none"> <li>➤ Wetlands and floodplains control floods in coastal areas, inland river basins, and mountain areas subject to glacial melt</li> <li>➤ Peat lands, wet grasslands and other wetlands store water and release it slowly, reducing the speed and volume of runoff after heavy rainfall or snowmelt in springtime</li> </ul>	<ul style="list-style-type: none"> <li>➤ Coastal wetlands, tidal flats, deltas and estuaries reduce the height and speed of storm surges and tidal waves</li> <li>➤ Marshes, lakes and floodplains release wet season flows slowly during drought periods</li> </ul>
<b>Coastal (Mangroves, saltmarshes, coral reefs, barrier islands, sand dunes)</b>	<ul style="list-style-type: none"> <li>➤ Coastal ecosystems protect against hurricanes, storm surges, flooding and other coastal hazards – a combined protection from coral reefs, seagrass beds, and sand dunes/coastal wetlands/coastal forests is particularly effective</li> <li>➤ Coral reefs and coastal wetlands, such as mangroves and saltmarshes, absorb (low-magnitude) wave energy, reduce wave heights and re-</li> </ul>	<ul style="list-style-type: none"> <li>➤ Coastal wetlands buffer against saltwater intrusion and adapt to (slow) sea-level rise by trapping sediment and organic matter</li> <li>➤ Non-porous natural barriers, such as sand dunes (with associated plant communities) and barrier islands, dissipate wave energy and act as barriers against waves, currents,</li> </ul>

		duce erosion from storms and high tides	storm surges and tsunamis, depending on the magnitude
<b>Drylands</b>	➤	Natural vegetation management and restoration in drylands contributes to ameliorate the effects of drought and control desertification, as trees, grasses and shrubs conserve soil and retain moisture.	➤ Maintaining vegetation cover in dryland areas, and agricultural practices, such as use of shadow crops, nutrient enriching plants and vegetation litter, increases resilience to drought
	➤	Shelterbelts, greenbelts and other types of living fences act as barriers against wind erosion and sand storms.	➤ Prescribed burning and creation of physical firebreaks in dry landscapes reduces fuel loads and the risk of unwanted large-scale fires
<b>Mountain forests, vegetation on hillsides</b>	➤	Vegetation cover and root structures protect against erosion and increase slope stability by binding soil together, preventing landslides	➤ Catchment forests, especially primary forests, reduce risk of floods by increasing infiltration of rainfall, and delaying peak floodwater flows, except when soils are fully saturated
	➤	Forests protect against rockfall and stabilise snow, reducing the risk of avalanches	➤ Forests in watersheds are important for water recharge and purification, drought mitigation and safeguarding drinking water supply

Source: Sudmeier-Rieux et al., 2019, p. 54 [18]

## 2.2 Disaster Experience to Support Adiwiyata School Program

Some studies found a significant correlation and impact between disaster experience and disaster preparedness [19][20][21], but several other studies found the opposite, there was no significant correlation [22][23]. In addition, the experience of a disaster can provide knowledge to the community about the threats or dangers caused by disasters and how to recover strategies [24][25]. This study seeks to explore how the disaster experiences experienced by students and teachers can support the 'Adiwiyata' school program with an Eco-DRR perspective. The involvement of young people (children and youth) in implementing the *Sendai Framework* globally is contained in *the 2019 Global Platform on DRR* [26]; which emphasizes the need to involve children and youth in designing and implementing policies, program plans, and standards in DRR in Indonesia.

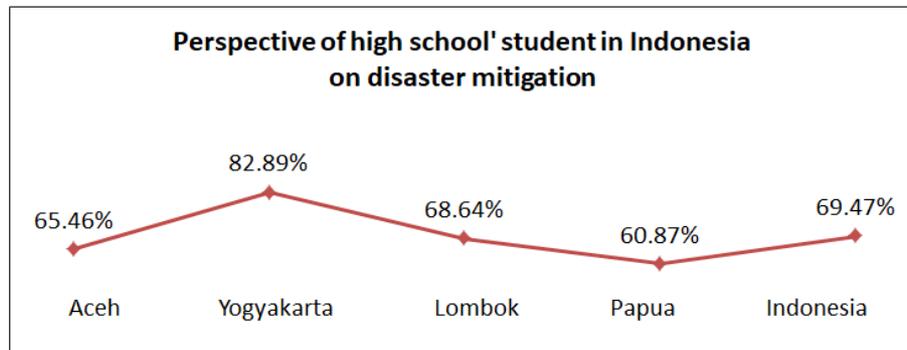
The Adiwiyata program initiated by the Ministry of Environment of the Republic of Indonesia – which in its implementation is in collaboration with the Ministry of Education and Culture – is based on educative, participatory, and sustainable principles [27]. In this context, educational institutions are expected to play an important role in protecting and managing the environment. Schools can be used as the right

place to raise children's awareness, sensitivity, and concern for the environment from an early age [12][28][29]. The disaster experiences experienced and owned by students and teachers can be a contextual learning resource and can be systematized and/or integrated with eco-DRR in the school curriculum in Indonesia. For this reason, schools are required to develop school policies that do not only focus on developing cognitive aspects as is often the case in the field, but also design school policies related to affective and psychomotor aspects [28][29]. This last policy is expected to be able to foster a culture and character of students who care about the environment.

The role of schools to develop disaster risk reduction knowledge is important at all levels of education, including in terms of disaster risk management. The results of Dwiningrum's research [11][30] found that in terms of disaster risk management, schools have the power and ability to: (i) detect disaster risk, (ii) understand vulnerabilities, and (iii) conduct disaster impact assessments. 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 disaster-aware culture is formed. This learning ability is an important part of the process of forming a disaster-aware school culture. Efforts made by schools to improve understanding of disaster risk for students (teenagers) include: (i) the importance of understanding that 'disaster' is inevitable, but with the spirit of humanism to free people from disasters so that they are able to manage threats and reduce vulnerability, (ii) this understanding teaches the community that any form of natural threat can occur, but how to develop thinking to reduce the risk (mitigation) of these threats is important to develop, (iii) in a psychological perspective, a comprehensive understanding of natural threats and how to interpret them is determined by public perception. If the perception that develops is based on a correct understanding of disasters, it will be easy to clarify the problems that occur, including the consequences that follow, (iv) from a sociological point of view, understanding disasters can be understood in a social dynamic and social static framework to provide a clear picture comprehensive information on the development and progress of the community in responding to and managing disasters [30].

### **2.3 Involving Youth to Campaign for the Importance of Eco-DRR**

Knowledge about disaster is empirical. Empirical knowledge is obtained from direct observation and experience. However, knowledge is obtained by rational observation, so that they can describe through a systemic explanation of an empirical object [30]. Empirical knowledge is knowledge that is obtained through individual personal experiences that occur repeatedly in his life. For example, a student (adolescent) who has been a disaster volunteer will be more skilled in carrying out the disaster evacuation process than someone who is not. What the student experienced is an example that the disaster that is experienced by an individual is able to encourage him to have disaster awareness and concern for the impact (danger) of disasters that occur around him. To provide an empirical description of the level of disaster knowledge possessed by high school students in Indonesia, the following is presented the results of Dwiningrum's research [11] regarding the comparison of mitigation knowledge of Indonesian high school students in several disaster-prone areas.



**Fig. 1.** Comparison of mitigation knowledge of high school students in Indonesia

The results of Dwiningrum's research in Aceh, Yogyakarta, Lombok, and Papua concluded that not all schools in disaster-prone areas have the disaster mitigation policies, let alone the awareness of the importance of disaster mitigation has not become a school priority program [11]. An empirical picture of the level of disaster knowledge possessed by school students can be seen in Figure 1. The data illustrates that the knowledge of high school / vocational students in Yogyakarta about disaster is relatively higher than the high school in Aceh, Lombok, and Papua. This difference in the level of disaster knowledge has implications for the role of high school students in the disaster mitigation process. In particular, the Disaster Education Consortium has formulated school-based disaster preparedness to increase disaster resilience in the community and to reduce the impact/risk of disasters [31]. The school preparedness parameter should consist of four factors: (i) attitudes and actions: The structure and content of the curriculum should contain knowledge of the hazards, vulnerabilities, disaster risk capacities and history around the school; and activities (ie simulation and training), and skills that can reduce risk; (ii) school policies: availability of policies, agreements, or regulations that support DRR; (iii) preparedness planning: all interested parties should cooperate in designing DRR assessment documents, school action plans for disaster management, standard operating procedures, evacuation maps, and early warning systems; (iv) resource mobilization: school building structure, quantity and type of post-disaster equipment, supplies, and basic needs owned by schools must comply with safety standards; cooperation between school teacher councils, and other professional teachers, as well as district/city disaster management.

### **3 Materials and Methods**

This qualitative research aims to explore and elaborate the understanding of students and teachers about the Adiwiyata School's programs and policies which implement the values and moral messages of Eco-DRR, especially at SMA Negeri 2 Banguntapan, Yogyakarta, Indonesia. For this reason, this research explores and deepens the data (field) through document analysis (secondary data), and confirms it further through interviews and observations.

This research uses data analysis of the Spradley model [32], which is based on the results of the interpretation of the reality or phenomena found - in the form of the informants' conceptions of the meaning and terms/languages of the informants related to the focus of the research, which are then verbally combined with researchers' way of speaking, of course, after a deep understanding (*verstehen*) of the socio-cultural reality. To find cultural meanings and deep interpretations, the researcher refers to the stages of analysis proposed by Spradley [32], which consists of four types of analysis, namely: domain analysis, taxonomic analysis, component analysis, and theme analysis. The specific culture-sharing group approach is used in this study to explore, explore, analyze, and describe the beliefs, values, practices, perceptions, and shared traditions of the informants in implementing the policies and programs of the Adiwiyata School with an Eco-DRR perspective in SMA Negeri 2 Banguntapan, Yogyakarta, Indonesia.

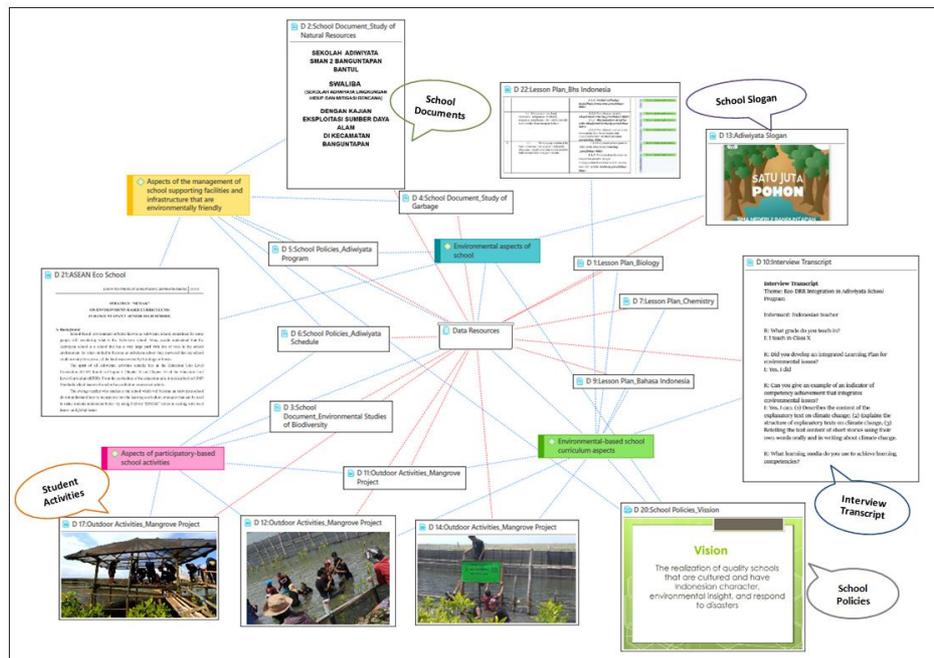
### **4 Results**

This research reveals that the disaster that is experienced by students and teachers have increased their knowledge, sensitivity, and awareness of Eco-DRR – which in practice is integrated through the 'Adiwiyata School' program as one of the school's flagship programs. Referring to the focus of the research, the following research results present two important points: (i) the implementation of the 'Adiwiyata School' program at SMA Negeri 2 Banguntapan, and (ii) the good practice of Eco-DRR integration through the 'Adiwiyata School' program.

#### **4.1 Implementation of the 'Adiwiyata School' Program at SMAN 2 Banguntapan**

The 'Adiwiyata School' program implemented by SMA Negeri 2 Banguntapan is intended to create a school that cares and has an environmental culture based on educative, participatory, and sustainable principles. Environmental school cultural activities at SMA Negeri 2 Banguntapan are in the form of routine and non-routine activities, physical and non-physical activities, as well as activities inside and outside the school. These school activities are a reflection of Adiwiyata schools that carry out environmental care programs in their daily activities. The reflection of the Adiwiyata

school also exists in every individual in it, the individuals in the Adiwiyata school mostly have an attachment and custody for the environment, this is because the organization adopted in this case the school has implemented a school culture that is environmentally friendly. To identify the various activities of school residents in implementing the 'Adiwiyata School' program at SMA Negeri 2 Banguntapan, it can be seen in Figure 2 below.



**Fig. 2.** Example of data analysis visualization of the implementation of the 'Adiwiyata School' program via ATLAS.ti 22<sup>th</sup> Edition software

When referring to the visualization of data analysis through the ATLAS.ti 22<sup>th</sup> Edition software, it appears that the implementation of the 'Adiwiyata School' program at SMA Negeri 2 Banguntapan includes aspects of school policies that are environmentally sound, aspects of the school curriculum based on the environment, aspects of participatory-based school activities, and aspects of management environmentally friendly school supporting facilities and infrastructure – whether held at school or outside of school. To strengthen the findings about the various activities of school residents in the implementation of the 'Adiwiyata School' program, the following are excerpts from teacher interviews and an analysis of the learning implementation plan document.

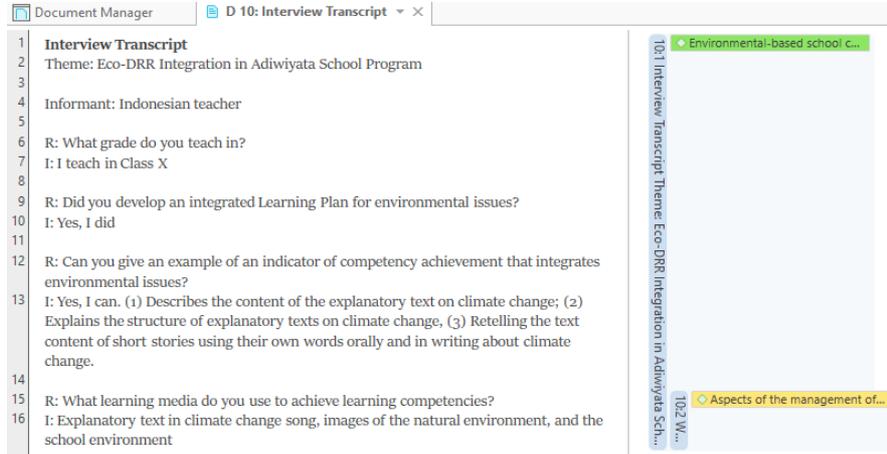


Fig. 3. Example of an informant statement

In the quote from Informant I's statement above, it appears that the implementation of the Adiwiyata program is also contained in the lesson plans prepared by the teacher. For example, in Indonesian lessons, the teacher formulates indicators of competency achievement, including: (i) explaining the contents of an explanation text about climate change, (ii) explaining the structure of an explanation text on climate change, (iii) retelling the contents of a short story text using words themselves orally and in writing about climate change.

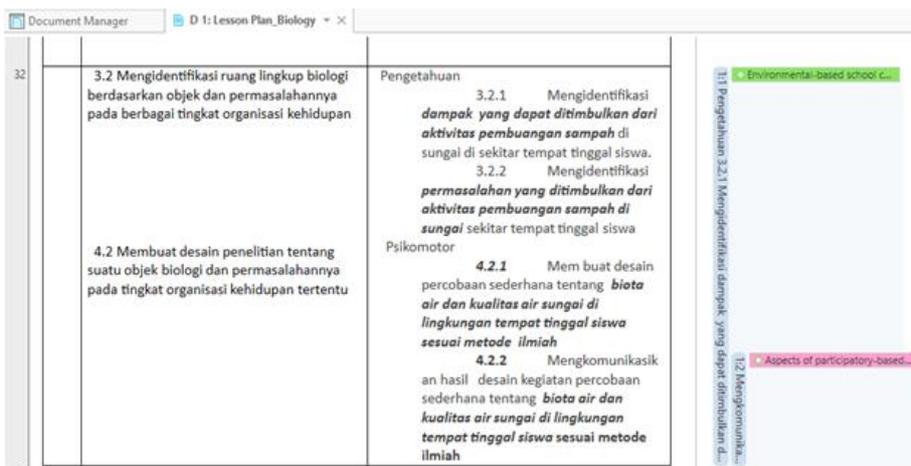


Fig. 4. Example of learning planning document analysis

Findings about the implementation of the Adiwiyata program are also evident in the environmental-based school curriculum aspect, through learning planning documents prepared by teachers. Figure 4 shows that Biology teachers formulate indicators of competency achievement, including: (i) identifying the impacts that can be generated from waste disposal activities in rivers around students' residences, (ii) identifying problems arising from waste disposal activities in rivers around students' residences, (iii) making a simple experimental design about water biota and river water quality in the student's living environment according to the scientific method, and (iv) communicating the results of a simple experimental activity design on water biota and river water quality in the student's living environment according to the scientific method.

#### **4.2 Good Practices of Eco-DRR Integration through the 'Adiwiyata School' Curriculum**

SMA Negeri 2 Banguntapan's slogan 'Smart is crucial, morality is more' has become a reference in implementing educational practices, including the implementation of the 'Adiwiyata School' program; both in class and outside of class. The research findings state that the types of disasters experienced by students and teachers in Yogyakarta include: earthquakes, volcanic eruptions, landslides, floods, droughts, forest and land fires, tornadoes, and waves/abrasions. On this basis, schools feel the need to integrate ecosystem-based disaster risk reduction (eco-DRR) efforts into the 'Adiwiyata School' curriculum which is one of the school's flagship programs. The good practice of integrating Eco-DRR through the 'Adiwiyata School' program that takes place in schools can be done individually or in groups. Usually this practice is integrated with activities that are in intra-curricular, co-curricular, and extra-curricular. This can be traced from the statements of informants during interviews, news from the school web, school documents, and documentation of school community activities as shown in Table 2.

In particular, SMA Negeri 2 Banguntapan has an integrated mangrove planting program through co-curricular and extra-curricular activities, 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 improve protected functions, as well as implementing disaster risk reduction (eco-DRR) through the Adiwiyata School program. The mangrove planting activity was chosen by the school as an important part of the implementation of Eco-DRR because it involves the participation of the school community (students and teachers), is cost-effective, socially friendly, and sustainable. Mangrove planting activities carried out by students and teachers of SMA Negeri 2 Banguntapan can be seen from the following pictures.



**Fig. 5.** Mangrove planting and care by students and teachers SMAN 2 Banguntapan  
(Source: SMA Negeri 2 Banguntapan Document)

The study revealed that the disaster experiences experienced by students and teachers have increased their knowledge, sensitivity, and awareness of Eco-DRR. In particular, the types of disasters experienced by students and teachers in Yogyakarta include; earthquakes, volcanic eruptions, landslides, floods, droughts, forest and land fires, tornadoes, and waves/abrasion. On this basis, schools feel the need to integrate ecosystem-based disaster risk reduction (eco-DRR) efforts into the 'Adiwiyata School' curriculum which is one of the school's flagship programs. The study also shows that the lesson plans have integrated learning materials with the theme of ecosystems and disaster management paradigms. The learning program plans consist of three clusters:

- The Science cluster: (i) Biology examine the themes of virus, ecology, and environmental balance, (ii) Chemistry examine the theme of environment, (iii) Physics examine the theme of climate change
- The Social Studies cluster: (i) Geography examine the themes of mitigation and adaptation of natural disasters, human relationship with the environment, sustainable environment and sustainable development, mapping and geographic information systems for development, (ii) Sociology examine the themes of social change during and after disasters, social issues related to environmental issues, strategy for community empowerment in disaster mitigation, local wisdom in disaster mitigation

- The Language Cluster guides students' skills for effective reading, writing and speaking about climate change, environmental conservation, and disaster mitigation.

## 5 Discussion

The disaster that is experienced by the informants has implications for knowledge about disaster mitigation, especially ecosystem-based disaster risk reduction (eco-DRR). In addition, the experience of a disaster can also provide information to informants regarding the threats or dangers caused by disasters and strategies to recover. These findings indicate that the information the teachers convey about eco-DRR is closely related to the subjects they teach. In practice, each subject has integrated environmental issues in lesson planning and learning processes in the classroom and outside the classroom – as an implication of the school's 'Adiwiyata School' program. When they are being asked to relate the program to the idea and purpose of eco-DRR, informants were able to quickly identify several topics that could be taught in the subjects they were teaching.

The theme initiatives presented by the informants ranged from (i) pre-disaster or preventive efforts; (ii) during a disaster (emergency response), up to (iii) post-disaster (reconstruction and rehabilitation). This type of knowledge is 'genuine' knowledge obtained by informants from their disaster experiences, which are then expressed through their actions and attitudes [33][34]. The experience seems to influence them to think and engage in eco-DRR discussions [24][25]. The implication is that informants design learning activities that integrate ecosystem-based disaster risk reduction (eco-DRR) efforts into the 'Adiwiyata School' curriculum which is one of the school's flagship programs. The implementation of eco-DRR at the local level, especially in schools, has a different variety, one of which is found in the research location. Eco-DRR topics and activities were synchronized with the 'Adiwiyata School' program which had previously become the school's flagship program. The most interesting finding of this research was the discussion regarding youth participation and environmental-based social action that they carried out as an alternative to the strategy of 'grounding' eco-DRR. In addition, to contribute ideas at the global level, the discussion about eco-DRR as a school community-based social movement is also interesting to explore further.

### 5.1 Youth and Environmentally-Based Social Action: The Eco-DRR 'Embracing' Strategy

Involvement and participation of youth in disaster risk reduction (DRR) is very important to provide real experience and self-preparation from an early age, make decisions based on information, and plan safe follow-up after disasters for themselves and their communities. Young people, although not usually seen as active citizens in society, are becoming very aware of and supportive of environmental initiatives. Youth involvement is increasingly recognized as a way to guide young people to have

awareness, sensitivity, and concern for environmental conservation actions [35][36]. Acknowledging their role and contribution to demographic conditions that are thematically substantively integrated into the school curriculum is one of the strategies for grounding eco-DRR at the local level. Investing in building and strengthening the capacity of children and youth in eco-DRR can be done by making their peer educators (tutors) to raise awareness of disaster risk and climate change [26]. The involvement and participation of these youth in practice is expected to influence friends and family to carry out sustainable environmental management, conservation, and ecosystem restoration in reducing disaster risk whose main goal is to achieve sustainable development and resilience.

Establishing a mechanism to allocate more resources through youth-led eco-DRR projects is one strategy that schools can undertake to contribute to the implementation of the Sendai Framework at the local level. Assisting and meaningfully involving youth in eco-DRR actions, such as planting and caring for mangroves, is not just a form of environmental-based social action, but more than that. This form of engagement can be seen as the result of planned actions through school curriculum interventions, intentional, well resourced, facilitated, and often legally mandated. Meaningful engagement is an ongoing activity with regular communication, both formal and informal (i.e., more than one time planning and participation in a program). It takes time to learn how to share and distribute tasks and responsibilities so that the social actions carried out by youth can be successful according to the planned targets. This is very important to allow teenagers to grow and develop according to their thoughts. On the other hand, community support in a wider context is needed to encourage the development of knowledge and good practices initiated by youth. Working with youth to develop strategies for how to increase the impact of environmentally based social action not only creates the possibility to do so, but also generates honest conversations about the complexities of inclusivity, governance and representation. With this knowledge, youth can develop their own strategies to overcome difficulties, such as joining global networks to plan environmental campaigns and movements to generate local-global community-based social capital, or mobilizing and advocating environmental movements which in turn can contribute to the implementation of the environmental movement through Sendai Framework.

## **5.2 Eco-DRR as a School Community-Based Social Movement**

The process of disaster risk reduction (DRR/Disaster Risk Reduction) is closely related to climate change adaptation and mitigation, but few DRR plans consider this relationship [14] [15]. Generally, eco-DRR/EbA is used as an instrument of adaptation and non-structural risk management. It has been explained that the research priority focuses on exploring student learning activities through intra-curricular, co-curricular, and extra-curricular activities to map and describe the extent to which eco-DRR is implemented at the local level, especially in schools. Research findings reveal that learning activities that are integrated with eco-DRR are part of non-structural measures implemented by schools to involve young people in school community-

based social movements. Community-based approaches are essential as part of non-structural eco-DRR measures, as local commitment is required to make any approach sustainable [31][35]. Non-structural actions in eco-DRR are understood as actions that do not involve physical construction; but using knowledge, practices or agreements to reduce risks and impacts, in particular through policies and legislation, public awareness raising, training and education [37]. Non-structural measures are characterized by promoting community participation. In the context of this research, eco-DRR can be said as a school community-based social movement, where students are invited and trained to have knowledge, sensitivity, awareness, and concern for ecosystems through the 'Adiwiyata School' program.

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 ecosystem approach is self-actualization and community from the disaster experiences they experienced as a person living in Yogyakarta. It is known that Yogyakarta has a unique demographic and physical condition as well as cultural wealth. The area of Yogyakarta stretches about 32.50 km<sup>2</sup>; which is configured by volcanic processes in the north, denudation processes in the west, solution processes in the southeast, marine processes along the south, fluvial processes in the middle, and structural processes in the south and southeast. These physical conditions induce several different natural hazards in certain areas, in addition to forming a heterogeneous ecosystem. On the other hand, Yogyakarta's cultural wealth is able to build strong community social capital, which plays an important role in ecosystem management, particularly related to disaster risk reduction (DRR). Eco-DRR as a school community-based social movement certainly has several special characteristics that are important to consider if it is to be disseminated on a wide scale. **Space.** Adolescents can safely explore and express their views before and after a catastrophic event. For youth from marginalized groups, it is necessary to create an enabling environment, for example with inclusive laws and policies, or focus on unfair power shifts that may limit the space to safely share their authentic views. **Voices.** Adolescents have the skills, capacity and confidence to express their views at all stages of disaster risk reduction. Strengthening the 'voice' includes active attention to addressing issues of poverty, discriminatory cultural norms or other factors that may limit participation. **Audience.** Adolescents are listened to and their point of view is respected in assessing, mitigating, preparing for and responding to danger. This includes having ongoing mechanisms and opportunities for youth to participate in DRR strategic plans from local to global levels. **Influences.** Youth perspectives are not only heard, but acted upon in risk reduction and resilience policies, programs and standards that affect their lives and the community.

## 6 Conclusion

The efforts to understand disaster risk as priority 1 in the Sendai Framework can be done through educational practices in schools. Through curriculum interventions, which are specifically integrated in intra-curricular, co-curricular and extra-curricular

activities – it is very possible for eco-DRR to be socialized and implemented. A non-structural approach in implementing eco-DRR can be done by involving youth to actively participate in sustainable environmental management, conservation, and ecosystem restoration in reducing disaster risk. The implementation of eco-DRR in educational practice that involves the active participation of youth must pay attention to several important components, namely: attitudes and actions that are explicitly visible in the structure and content of the curriculum; school policies that support eco-DRR; preparedness planning that involves multi-stakeholder involvement in DRR; and resource mobilization related to infrastructure, cross-sectorial partner networks, and disaster management. Thus, schools can be used as the right place to raise children's awareness, sensitivity, and concern for the environment from an early age so that sustainable development and resilience can be achieved gradually, starting from the local to the global scope.

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