

Conference

Preparedness and Adaptive Capacity of Students for Landslide Disasters in Karangkobor, Central Java, Indonesia

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Abstract. Landslides are disasters that often hit several areas in Banjarnegara Regency. The worst landslide incident which claimed many victims occurred on December 12, 2014, in Jemlung Hamlet, Sampang Village, Karangkobor District, which resulted in the settlement of one hamlet being buried. The high risk of landslides in the Karangkobor District necessitates adequate preparedness and capacity. The focus of the research was to determine (1) the level of student preparedness for landslides in Karangkobor District, (2) the level of student adaptive capacity for landslides in Karangkobor District, and (3) the relationship between preparedness and student adaptive capacity. The researchers used a quantitative descriptive method and collected data using questionnaires, observations, and secondary data on disaster events from the Central Regional Management Agency (BPBD) of Banjarnegara Regency. Four junior high schools in the Karangkobor District were studied. The findings showed that preparedness was homogeneous across the four schools. The level of preparedness was moderate, with an index of 71% - 75%. MTs Muhammadiyah Karangkobor was in the high category for adaptive capacity with 80.54%, and other schools were classified as medium. Preparedness correlated with adaptive capacity, with a significance value of 0.035 (<0.05).

Keywords: disaster, preparedness, adaptive capacity, landslide

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1. Introduction

Disaster events are global problems that cannot be avoided and will always occur, one of which is in Indonesia. Indonesia has a geographical, hydrological, and demographic location that allows disasters to occur (1). Indonesia has the potential for natural and non-natural disasters. A Natural disaster is a disaster event caused by a series of natural events, including earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes, and landslides (2). These disasters occur when extreme geological, meteorological, or hydrological conditions exceed the ability of a community to deal with the event (3). Seeing Indonesia's geographical situation on the world's active plate

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has earned Indonesia the nickname of a ring of fire. Concerning Indonesia's location, Indonesia is also referred to as a disaster supermarket (4).

During the 2016-2020 period, there were 17,494 natural disasters in Indonesia, and 36318 people became victims of natural disasters (5). The trend of natural disasters that often occur in Indonesia during the last five periods (2016-2020), landslides are among the tragedies that dominate compared to other disasters. Namely, there were 3,969 disasters (6). Indonesia has at least 918 locations indicated as areas at risk of landslides, and as many as 40.9 million Indonesians live in these areas (7). Data Center for Volcanology and Geological Hazard Mitigation (PVMBG) mentions the distribution of landslides in Figure 1.1 that Java Island has a high-risk index for landslide events. It is affected by the morphology of Java, which partly consists of highlands and steep hills; the second is the high rainfall index in Java in October-April; and thirdly, there are 36 active volcanoes in Java out of 126 volcanoes in Indonesia that produce weathered volcanic material (8).

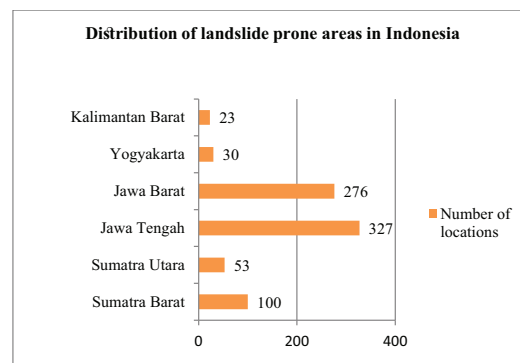


Figure 1: Distribution of landslide prone areas.

Natural or non-natural factors can cause landslides. Landslides generally occur triggered by high rainfall intensity (9). Geological structures in the form of joints and faults are also triggering factors that play a role in landslides (10). Landslides caused damage to public facilities, agricultural land, casualties and even paralyzed the economic activities of people affected by the disaster. The districts in Central Java that have the potential for landslides include Purworejo, Kebumen, Magelang, Karanganyar, Klaten, Kendal, Pekalongan, Jepara, Sragen, Kudus, Pati, Cilacap, Banyumas, Purbalingga, Banjarnegara, Batang, Tegal, Brebes, Semarang (11). The large number of areas indicated as landslide-prone zones shows Indonesia's low level of disaster mitigation.

Banjarnegara Regency is one of the regencies in Central Java Province geomorphologically located in the middle zone, part of the North Serayu Mountains mandala which has a slope of 15-40% the potential for landslides (33). There are several sub-districts

in Banjarnegara that are included in areas prone to landslides, namely Karangkoobar District, Wanayasa District, Susukan District, Banjarmangu District, Pagentan District, and Punggelan District (12). Karangkoobar District is one of the sub-districts in Banjarnegara Regency, located at an average altitude of 1015 meters above sea level (5). Karangkoobar sub-district is one of the sub-districts indicated as the highest landslide-prone area due to steep topographic conditions and has a loose soil structure.

Based on data from the BPBD of Banjarnegara Regency in 2018, 23 landslides in Karangkoobar District damaged access roads, plantations, rice fields, and even knocked down people's houses. Almost every year, Karangkoobar District is not spared from landslides. The most significant landslide incident in Karangkoobar District on December 12, 2014, occurred in Jemblung Hamlet, Sampang Village, hitting dozens of houses with the impact of 40 houses being heavily damaged and with a total of 108 victims (13). The chronology of the incident was caused by heavy rain. The landslide disaster that hit Jemblung Hamlet resulted in damage to public infrastructures such as government buildings, broken bridges, and road access (14). The high impact caused by landslides requires reducing vulnerability and increasing capacity.

Disaster events do not know where they occurred and who was affected, even differences in gender, age, ethnicity, or religion. Disasters often threaten vulnerable people such as children, women, and the elderly (2). Children are classified as vulnerable groups, so particular actions are needed to reduce disaster risk for children. Children are categorized as the most vulnerable to disasters because the capacity and resources related to disasters are still minimal (15). One of the efforts to increase the capacity and resources of children is through disaster education.

Several academic units are located in landslide-prone areas in Karangkoobar District, namely MTs Muhammadiyah Karangkoobar, Ma'arif NU 1 Karangkoobar Middle School Karangkoobar Junior High School 1, and Karangkoobar Junior High School 3. The high number of vulnerabilities in these schools requires an increase in preparedness through the implementation of disaster education. Disaster education is the foundation of disaster risk reduction efforts (16). However, the role of disaster education in schools in disaster risk reduction efforts is still relatively low. The weak role of schools as the foundation of disaster education will impact every component in schools such as students, teachers, the learning process, damage to infrastructure, and result in the threat of the future of students (17). The problem is that academic units located in disaster-prone areas have a high level of exposure when there is no provision of knowledge, abilities, and supporting infrastructure in dealing with disasters. This

problem should be a reference for disaster management institutions and schools so that schools located in exposed areas have preparedness and adaptive capacity for catastrophe.

Strengthening preparedness is considered one of the critical efforts in responding and recovering after a disaster event (18). Disaster preparedness is influenced by spatial conditions, in which local preparedness is considered crucial. Disaster preparedness is an effort applied to schools to minimize the impact of a disaster. Schools located in disaster-prone areas side by side with hazards should ideally have cultural preparedness. Cultivating preparedness means that individuals are accustomed to dangerous conditions so that when a disaster suddenly occurs, it means that all can act quickly and appropriately. Quick and appropriate action in the face of danger is a form of adaptive capacity. Adaptive capacity is defined as a form of the ability of a self-system to change its habits in resolving existing or future pressures for the better (19). The components of adaptive capacity are education, security, technology, expertise, infrastructure, information, resource accessibility, stability, and ability regulation (20). Adaptive capacity is essential to deal with disasters because it is a fundamental concept that is often overlooked in vulnerability and resilience frameworks.

Preparedness and adaptive capacity are needed to form a resilient community to face disasters. Resistant to disasters means having the ability to adapt and resurrect themselves to the impact of burdensome disaster losses. Based on the data collection results consisting of school observations and disaster data from BPBD Banjarnegara Regency, Junior High Schools (SMP) in Karangkojar District are schools that have a risk of landslides. Seeing the frequent occurrence of landslides, junior high schools in Karangkojar District face the threat of landslides that can occur at any time. These conditions make school students must have good preparedness and capacity to adapt to these conditions. In each indicated school, of course, has a different level of preparedness and level of capacity. This has led researchers to conduct research related to "Students' Preparedness and Adaptive Capacity for Landslides Disasters in Karangkojar District, Banjarnegara Regency." The formulation of the problem in this study are, (1) What is the level and distribution of student preparedness for landslides in Karangkojar District?, (2) How is the adaptive capacity of students in dealing with landslides in Karangkojar District?, (3) How is preparedness related to capacity? Student adaptive to landslide disaster in Karangkojar Sub-district?.

2. Theoretical framework

2.1. Preparedness

Preparedness is a series of disaster events that are included in the pre-disaster phase. Preparedness is defined as a series of actions taken to anticipate disasters through appropriate and efficient organization and steps (2). Preparedness in dealing with disasters is one measure to determine vulnerability (21). As for the organizing actions of disaster preparedness, (1) an early warning system, as a warning sign of danger in a quick time by the competent authority to the community about the possibility of a disaster; (2) Preparedness plan, is the planning and selection of appropriate steps to ensure the availability of resources; and (3) contingency plans, namely sustainable plans in dealing with situations that are not certain to occur (22).

It is necessary to integrate disaster management in the education sector, namely in the form of school-based preparedness (23), because it is possible for schools to be at risk of being affected by disaster events (24). The need for integration of preparedness in education is because education is the main factor in implementing disaster risk reduction. Education-based disaster preparedness is needed to prepare basic community knowledge (25). The indicators used in measuring students' disaster preparedness are, 1) Knowledge and attitudes towards disaster risk; 2) Policy; 3) Emergency response plan; 4) Early warning system; and 5) Resource mobilization (26). The disaster preparedness parameters described have a relationship with one another and cannot stand alone.

2.2. Adaptive Capacity

Capacity can be perceived as an exclusive design illustrated through a consistent and multidimensional system, and results can then prove that there is a development in an object (27). The UN global development network United Nations Development Program (UNDP) explains that capacity is the process by which an individual, organization, or community develops skills in carrying out roles, solving problems, and determining and achieving independently selected goals (28). While adaptation is defined as a series of activities and activities carried out by people in response to changing circumstances to defend themselves (29). Adaptation is the process of understanding a strategy to resolve and take advantage of the consequences of changing circumstances (30). Adaptive capacity describes the capability of order and group to cope with the consequences and risks of a change, including the ability to determine behavior in using resources and

technology (19). According to (31), Adaptation capacity is a resource that is constantly moving, namely robustness, redundancy, and rapidity. Adaptive capacity is divided into three dimensions: awareness; ability; and actions (32). Figure 2 shows the indicators for each measurement, namely knowledge and experience, social learning for awareness, individual competence, and access to resources to determine the dimension of ability and adaptations made for the extent of action. These three dimensions are interrelated.

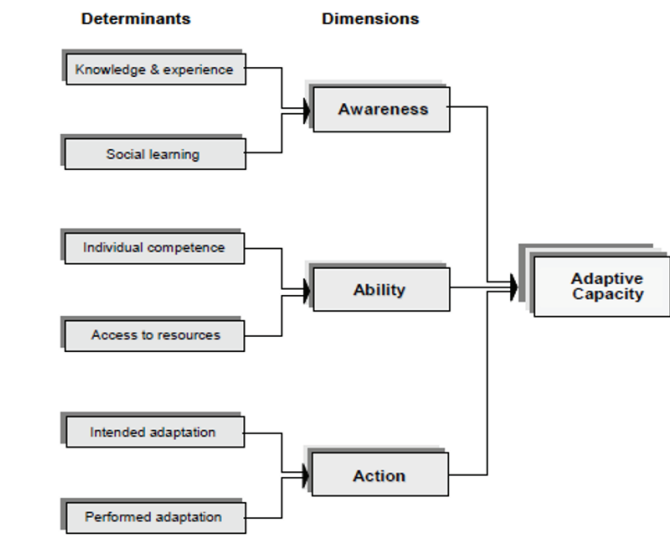


Figure 2: Dimension of adaptive capacity. *Source:* Eugenio et al. (32).

3. Methods

The research methods should elaborate on the technique utilized in addressing the issues, including analysis. The type of research applied by the researcher to the research is in the form of quantitative descriptive. This type of descriptive research with a quantitative approach aims to describe the events under study supported by literature studies. The structure of the research design used is a survey. The research location is in Karangobar District, Banjarnegara Regency, with a research population of high school students/equivalents, namely grade 9 consisting of 85 students of MTs Muhammadiyah Karangobar, 65 students of Ma'arif NU 1 Karangobar Middle School, 223 students of SMP N 1 Karangobar, and SMP N 3 Karangobar 28 students with a total population of 401 students. The sampling technique applied by the researcher in the sample study at each school is based on the Slovin formula (Table 1), which shows the distribution of the sample with a total of 80 respondents.

The data collection technique used a questionnaire in the form of a closed questionnaire distributed to students directly and partly through a condition due to the limited

TABLE 1: Distribution of Research Samples

No	Schools	Population	Number of respondents
1	MTs Muhammadiyah Karangobar	85	17
2	SMP Ma'arif NU 1 Karangobar	65	13
3	SMP N 1 Karangobar	223	44
4	SMP N 3 Karangobar	28	6
Jumlah		401	80

Source: fieldwork, 2021.

face-to-face learning. The scale used in the questionnaire is using the gunmen scale, namely "Yes" and "No." The data analysis technique used was scoring from the questionnaire data and then continued with spatial analysis to determine the distribution. Meanwhile, for the third problem formulation, correlation analysis was conducted to determine the relationship between variables.

4. Results and Discussion

4.1. Landslide Disaster Preparedness

Determination of the value of students' level of preparedness against landslides in Karangobar District was carried out using a questionnaire with five parameters, namely 1) knowledge of disaster risk; 2) policy; 3) emergency response plan; 4) early warning system; and resource mobilization. Assessment is focused on junior high school students/equivalent. The study results are described in the form of percentages divided into three levels, namely 80-100% as the high category, 60-79% as the medium category, and less than 60% as the low category. The results of the assessment of student preparedness for landslides in Karangobar District are as follows:

4.2. Knowledge

Knowledge assessment includes understanding disasters, causes of disasters, disaster characteristics, and steps taken when disasters occur. Table. 2 Students' knowledge of disasters shows the results obtained from measurements.

The knowledge parameter shows that the percentage of the graph is relatively the same at the level of knowledge. The index ranges from 80-100%, which means that the knowledge of junior high school students/equivalent in Karangobar District

TABLE 2: Students' knowledge

No	Schools	average answer Yes (max. 5)	Weight	Score (average/5*weight)	Percentage (Score/weight*100)
1	SMPN 3 Satu Atap Karangobar	3,5	35	35	100
2	SMP Ma'arif Nu Karangobar	4,3		30,1	86
3	SMPN Karangobar	1 4,54		31,78	90,8
4	MTs Muhammadiyah Karangobar	4,59		32,13	91,8

Source: fieldwork, 2021

about disasters, especially landslides, is in the high category. The increased knowledge possessed by most students was obtained through socialization activities carried out by the Regional Disaster Management Agency (BPBD) of Banjarnegara Regency.

4.3. Policy

Policy indicators include the implementation of disaster materials in schools, the existence of supporting infrastructures such as the availability of disaster modules/books, and training and simulations by policy owners, both schools and related institutions. Training and simulation activities are carried out to build school communities that are resilient to landslides. Table. 3 shows the results of the policy index on landslides in each school.

TABLE 3: Disaster policy

No	Schools	Average answer Yes (maks. 3)	Weight	Score (Average /3*weight)	Percentage (Score/weight*100)
1	SMPN 3 Satu Atap Karangobar	3	10	10	100
2	SMP Ma'arif Nu Karangobar	3		10	100
3	SMPN Karangobar	1 2,89		9,63	96,3
4	MTs Muhammadiyah Karangobar	2,53		8,43	84,3

Source: fieldwork, 2021

The description of disaster policies in each school varies but is still in the high category. At MTs Muhammadiyah Karangobar school, the percentage score is lower than other schools because, on the question of the availability of disaster guidebooks in schools, some respondents have a score of "0".

4.4. Emergency Response Plan

Emergency response plans in the research studied are plans related to evacuation, self-rescue during disaster events to minimize the number of losses due to casualties. The evacuation and rescue plan includes mapping vulnerable areas, safe places, and the availability of evacuation routes. Table. 4 measurement results are used to measure how students in Kaangkobar District understand this.

TABLE 4: Emergency Response Plan Index

No	Schools	Average answer Yes (max. 6)	Weight	Score (average /6*weight)	Percentage (Score/weight*100)
1	SMPN 3 Satu Atap Karangobar	4,5	15	11,25	76,7
2	SMP Ma'arif Nu Karangobar	4,5		11,25	76,7
3	SMPN Karangobar	1 5		12,5	83,4
4	MTs Muhammadiyah Karangobar	4,18		10,45	69,7

Source: fieldwork, 2021

The average percentage score obtained in each school shows that the emergency response plan is moderate, namely at moderate vulnerability. SMPN 1 Karangobar has a higher score than other schools, 83.4, in the high category. The difference in scores was found because most students could find a safe place when a disaster occurred, and was supported by an explanation from the student council that at SMPN 1 Karangobar, there were disaster newspaper clippings, and disaster pocketbooks were available in the school library. This is different from the case in other schools that have not provided disaster newspaper clippings and disaster pocketbooks in the school library.

4.5. Early Warning System

Early warning parameters are used to reduce the number of fatalities through the warning signs given. Understanding early warning signs is also needed because without understanding students, students cannot understand early warning signs optimally. Researchers' investigation during the field shows that early warning tools for landslide disasters are available in priority locations prone to ground movement. The researcher then examines the extent to which the instrument is widely introduced, especially to still laymen students.



Figure 3: Installation of the Early Warning System (EWS) by BPBD Banjarnegara Regency. *Source: BPBD Banjarnegara Regency, 2020.*

TABLE 5: Early Warning System Index.

No	Schools	Average answer Yes (max. 3)	Weight	Score (Average /3*weight)	Percentage (Score/weight*100)
1	SMPN 3 Satu Atap Karangobar	1	25	8,4	33,4
2	SMP Ma'arif Nu Karangobar	1,6		13,4	53,6
3	SMPN Karangobar	1,52		12,7	50,7
4	MTs Muhammadiyah Karangobar	1,65		13,75	55

Source: fieldwork, 2021

Figure 1 shows that the EWS is available as a sign to convey a warning to the public when a warning about the danger of ground movement occurs. The calculation results (Table 5) show that the overall percentage of the early warning index in the event of a disaster that students have is relatively low, namely the vulnerable value of <60%. The early warning parameter shows low results even though the availability of EWS

is caused by the unfamiliarity of students with the warning signs of the tool and the absence of simulations or socialization to students regarding early warning tools.

4.6. Resource Mobilization

Mobilization is a parameter to measure the ability to move to a safer place, both in terms of human and non-human resources. Regarding the mobilization of resources for students, the parameter measurement is focused on the mobilization of human resources. Considerations in measuring parameters consist of skills possessed by students, such as evacuation skills, first aid obtained from activities at school.

TABLE 6: Resource Mobilization Index

No	Schools	Average answer Yes (max. 3)	Weight	Score (average /3*weight)	Percentage (Score/weight*100)
1	SMPN 3 Satu Atap Karangobar	1,5	15	7,5	50
2	SMP Ma'arif Nu Karangobar	1,2		6	40
3	SMPN Karangobar	1,02		5,1	34
4	MTs Muhammadiyah Karangobar	1,29		6,45	43

Source: fieldwork, 2021

The resource mobilization index for students (Table 6) shows the overall index value obtained in all schools is in a low category, with a vulnerable value of < 60%. The problem with students' low resource mobilization parameter index is that students have never carried out evacuation simulation activities. The lack of student involvement in school extracurricular activities can train students' abilities in first aid and emergency.

The tables above show the index for each disaster preparedness parameter that students have in each school. They are combined to obtain a total index of overall preparedness (Fig. 4) for landslides in the Karangobar District.

Picture. 4 shows the results that students' average level of preparedness is in the category of moderate preparedness with index values ranging from 60-79%. Of the four school locations at SMPN 3 Karangobar, the score is higher because most students live in areas with high landslide vulnerability, so their preparedness is higher than in other schools. The level of preparedness possessed by every student at schools in the Karangobar District is supported by the preparedness program carried out by the BPBD. The Banjarnegara Regency BPBD Preparedness and Prevention staff conveyed a

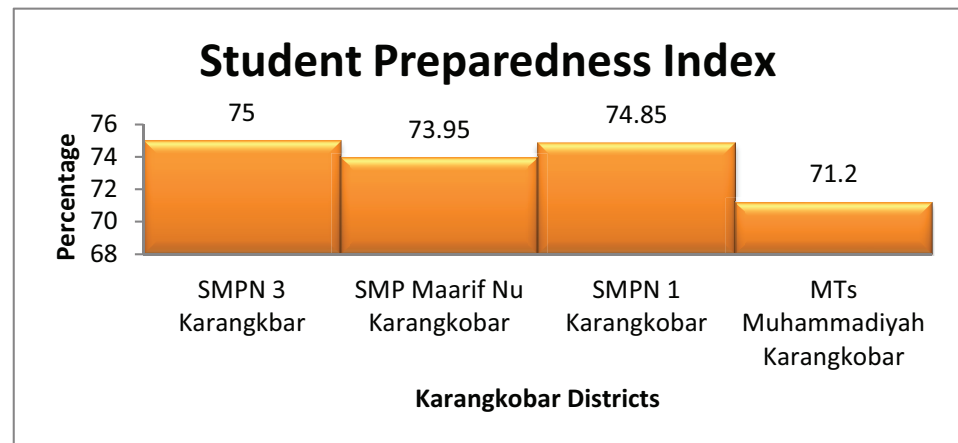


Figure 4: Evacuation Route Signs. *Source: fieldwork, 2021.*

preparedness program carried out in junior high school/equivalent schools in Banjarnegara Regency, which was named Educational Information Communication (KIE) which collaborated with supervisors at each school. Activities in the form of socialization and simulations, but during the Covid 19 pandemic, these activities were not carried out due to the limitations of face-to-face learning, thus affecting the preparedness of schools that had not yet participated in IEC activities.

4.7. Student Adaptive Capacity

The students' adaptive capacity index to landslides was obtained using scoring from questionnaires, observations, and documentation. The data obtained is used to determine the parameter index on the adaptive capacity to landslides. These parameters are experiential knowledge, social learning, individual competence, resource access, and adaptation actions.

The description of students' adaptive capacity (Fig. 5) reveals that different results are obtained in each school in terms of the dimensions of awareness of the knowledge and experience indicators. SMPN 3 Karangkoobar has high experience knowledge related to landslides in the high category with a score of 80%. The high level of expertise and experience is influenced by the frequent occurrence of landslides around the place of residence so that the experience is heightened. In contrast to students at SMP Ma'arif NU Karangkoobar, they have a low value of experiential knowledge due to the environment where students live; the intensity of landslides is smaller than students from other schools. The more frequent the history of landslides experienced, the higher the knowledge and experience possessed by each student.

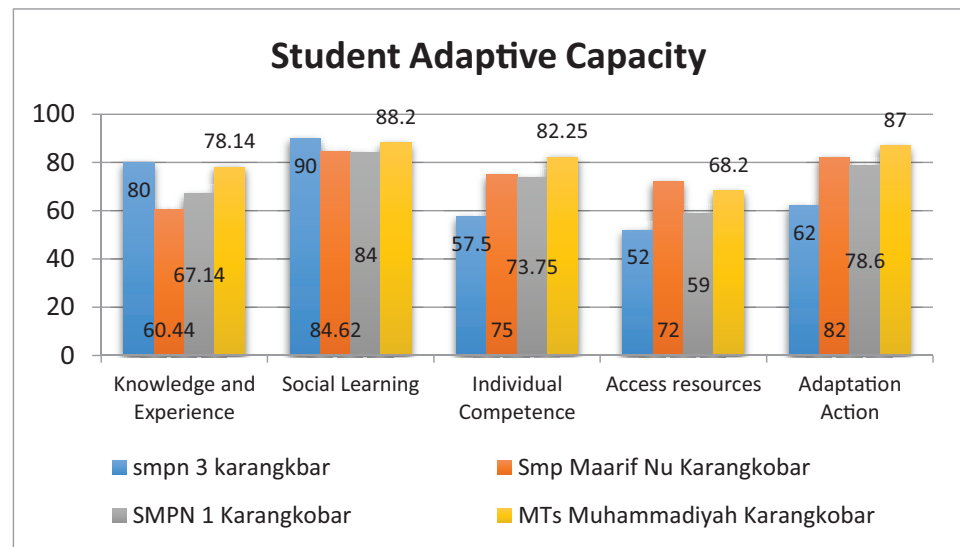


Figure 5: Overview of Student Adaptive Capacity Indicators. Source: fieldwork, 2021.

Parameters of social learning showed homogeneous results in each school, in the high category of 80%-100%. Students' high social learning parameters are influenced by the existence of community social activities related to disasters carried out by each school. Another factor that supports this high parameter is student participation in extracurricular activities such as scouting which every school requires, and PMR activities.

The measurement capability is used in the form of individual competence parameters and resource access. Parameters of personal competence in the form of psychological abilities possessed when faced with disaster events, understanding EWS, understanding to follow instructions for evacuation routes. The results show a heterogeneous level, where there is a gap in individual competence owned by students, which is 57%-82% vulnerable. The difference in different results is caused by each related to various psychological conditions and cannot be equated. The understanding of each student in terms of understanding the danger warning signs is still low. The resource access parameter on the capability dimension shows low to moderate results with a vulnerable value of 52%-72%. Assessment of resource access parameters is based on the resources owned by the family, such as livelihood, savings owned by parents, and insurance owned. The more assessments you have, the higher your ability to access resources. Maarif NU Karangkobar Junior High School is a school that has higher resource access capabilities than other schools; this is because the livelihood conditions and economic support owned by students' families are increased so that access to resources is higher.



Figure 6: Evacuation Route Signs. *Source: fieldwork, 2021.*

The last dimension of adaptive capacity is action in the form of adaptive action that can be taken. The assessment of these parameters includes standard operating procedures (SOP), the availability of evacuation routes, finding ewns, and assistance from related institutions in the event of a landslide. The results show that students' level of adaptation actions in each school varies, which is classified in the medium to high category (62% - 87%). The average respondent's answer regarding the SOP informed about the occurrence of landslides; students answered "no." Then, related to the evacuation route signs based on the researcher's observations (Fig. 6), they are fully available along the roads in Karangobar District and vulnerable areas, but some students do not understand the existence of these signs. Similarly, the availability of disaster warning tools.

The adaptive capacity of students in each school as a whole (Fig. 7) has varying values, namely in the medium to high category (70.5% - 80.54%). Of the five indicators assessed as parameters for measuring adaptive capacity, MTs Muhammadiyah Karangobar has a higher level of adaptive capacity than other schools. The higher the ability possessed by each student, the more prepared students are to live side by side with the risk of landslides.

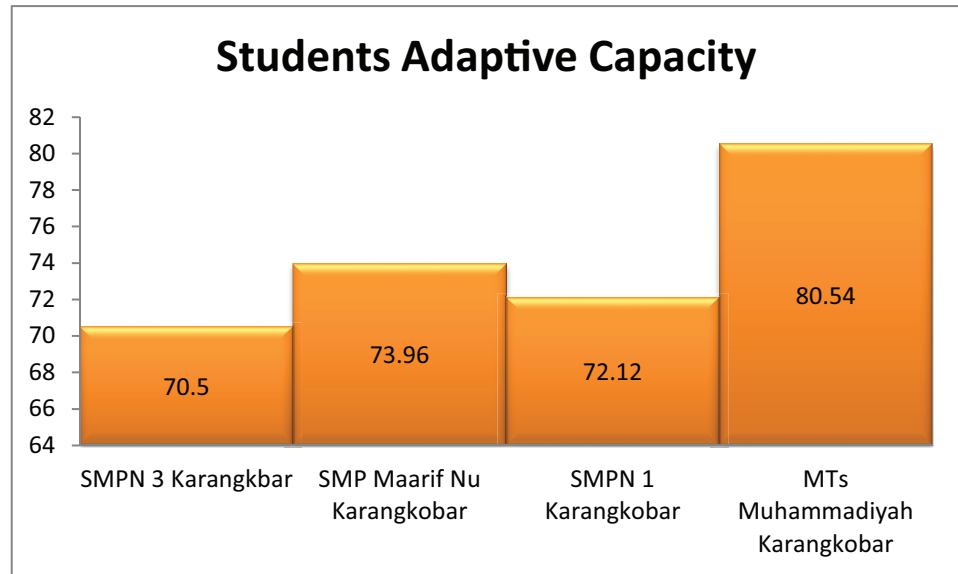


Figure 7: Levels of Adaptive Capacity Indicator. Source: fieldwork, 2021.

4.8. The Relationship between Preparedness and Student Adaptive Capacity

The analysis of the relationship between preparedness and adaptive capacity to disasters was obtained through correlation analysis using SPSS (Table. 7). The basis for decision-making analysis is using a significance level of 0.05, which if the correlation value is <math><0.05</math>, there is a relationship between preparedness and adaptive capacity.

TABLE 7: Correlation Test Results

Correlations			
		Kesiapsiagaan	Kapasitas Adaptif
Kesiapsiagaan	Pearson Correlation	1	.236*
	Sig. (2-tailed)		.035
	N	80	80
Kapasitas Adaptif	Pearson Correlation	.236*	1
	Sig. (2-tailed)	.035	
	N	80	80

*. Correlation is significant at the 0.05 level (2-tailed).

Source: analysis, 2021

The correlation test results between preparedness and adaptive capacity obtained a value of 0.035 (<math><0.05</math>) so that there is a relationship between preparedness and students' adaptive capacity in dealing with landslides. It can be said that if the preparedness is high, the adaptive capacity level is also high. Preparedness is one of the

crucial factors in adaptive capacity. It is essential to have good preparedness to adapt to environmental conditions that are prone to disasters. With good preparedness and capacity, students will be more concerned about disasters, and the risk of landslides in the Karangkoobar District can be minimized.

5. Conclusion

Based on the results of the analysis and discussion of research related to the preparedness and adaptive capacity of students against landslides in Karangkoobar District, the following conclusions are obtained:

1. Students' level of preparedness in each school against landslides in Karangkoobar District obtained homogeneous results belonging to the medium category (71% - 75%).
2. The students' adaptive capacity level to landslides in Karangkoobar District obtained varying results from the medium to high category (72% - 80.54%). The school with a high adaptive capacity is MTs Muhammadiyah Karangkoobar, with a score of 80.54%.
3. There is a positive relationship between preparedness and the adaptive capacity of students in dealing with landslides in Karangkoobar District with a correlation result of 0.236 and a sig level of 0.035 (<0.05).

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