Implementing Cognitive Intervention to Educate and Improve Resident's Preparedness in Landslide Areas

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Abstract. Semarang city has the potential landslides were quite high in almost all regions. The previous research shows that the Manyaran and Kembang Arum is classified as "not ready" with vulnerability-prone of landslide areas. Therefore, design and implementation of cognitive interventions in human are needed to educate and improve the preparedness of the residents against landslide. This study aims to implement the various cognitive interventions to the residents in landslide areas and analysis of the different interventions toward the preparedness index. The study is conducted on 40 respondents from Kembang Arum and 40 respondents from Manyaran. They are aged $\geq$ 17 years, illiteracy and a RT/RW/PKK cadres. The independent variables in this study are Knowledge and Attitude, Emergency Planning, Warning System, and Resources Mobilization. The dependent variable is the preparedness index. The design of cognitive interventions is generated according to the demographic characteristics of the respondent and the result of Fault Tree Analysis. The preparedness index of the residents against landslides in Kembang Arum increases about 71.71% and in Manyaran up to 90.06%. Implementation of cognitive interventions with module, video and discussion in the Manyaran is more effective than using posters, videos and discussions in Kembang Arum.

1 Introduction

The city of Semarang has high landslide potential in almost all areas [1]. Recently, some studies were focused only on technical aspects of disaster management such as logistic system [2-5] and geological aspect [6-7]. Public awareness of landslide disaster needs to be improved through community behaviour towards disaster prevention, understanding of equipment factors and the formation of community commitment to security plans made by Semarang City Government together with the community. Policies and programs undertaken by Semarang City Government are still focused on government institutions as those who serve emergency and post-disaster response even though the general population, especially the people in disaster prone areas, needs a proper education about the condition of the region. Based on data of geoelectric measurement result in 19 sites of soil prone area in Semarang City conducted by Putranto et al. [1], it was found that threesitesare very vulnerable, eightsitesare vulnerable, sixsitesare quite vulnerable, and two sites are slightly vulnerable. Manyaran and Kembang Arum villages are vulnerable. Based on previous research [8], analysis of residents preparedness to the landslide disaster in Semarang City based on the calculation of the index of preparedness in 19 areas of Semarang City categorisesManyaran and Kembang Arum Subdistrict in "not ready" level.

Based on the data of Manyaran and Kembang Arum sub-districts in 2016, the occurrences of landslide disaster in Manyaran and Kembang Arum sub-districts is quite high. The high potential of these hazards leads to the necessity of community empowerment to improve the success of disaster management and prevent the occurrence of material losses and casualties in the event of landslide disaster. Analysis of the causes of low residents preparedness index has been undertaken as an effort to empower communities by using the Fault Tree Analysis (FTA) approach [9-10].A cognitive intervention is a form of psychological intervention, technique and therapy in counselling exercises [11]. Acognitive intervention in disaster management has been considered as the key mental aspect of successful disaster management as explained in previous research. As the next stage of the research, this study is focusing on the implementation of cognitive intervention design as proposed by Susanto et al. [9] in two sub-districts (Manyaran and Kembang Arum) to improve the individual preparedness index against landslide disaster. This study develops in detail, the phase of cognitive intervention implementation as well as analyses each phase to obtain a valid and reliable design implementation to be adapted by each research area.

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2 Literature Reviews

Disaster management is an organizational and resource management and responsibility for addressing all aspects of humanitarian emergencies, special preparedness, response and recovery to mitigate disaster impacts [12]. Disaster management aims to reduce or avoid potential harm, ensure prompt and appropriate assistance to disaster victims and achieve rapid and effective recovery. In cycles, disaster management figures out the ongoing process planned by governments, businesses and civil society plans to mitigate impact, react immediately in the event of a disaster as well as disaster recovery [13]. Preparedness of the resident is a part from the disaster management that should be considered.

Regarding LIPI-UNESCO/ISDR policy [14], preparedness index was categorised into five parameters: knowledge and attitude, emergency planning, warning system, resource mobilization capacity and policy statement. The critical factors can be explained as follows:

1. Knowledge and Attitude) is a basic knowledge and attitude about disasters such as disaster types and factors, disasters, and procedures, locations and disaster evacuation routes. There are three variables in this parameter: natural and disaster events (type, source, quantity, and location), understanding of environmental vulnerability, and attitude during a landslide disaster.
2. Emergency Planning is the plan/action required to handle emergency situations in the event of disaster preparedness such as map making, temporary shelter, information hotline number, post, training/simulation, risk analysis and contingency planning. It includes disaster preparedness, evacuation plan and identification of emergencies.
3. Warning System is a series of systems to inform the occurrence of natural events, can be a disaster or other natural signs. In this case, the system relates to information systems, information delivery, and development of early warning systems, training and simulation.
4. Resource Mobilization Capacity is a training program (resources), community action, funds, social capital.

Measurements were made using a Likert scale questionnaire which is then weighted for each parameter with the weight of each parameter of 25%. After weighting, calculation of Preparedness Index (PI) can be taken into account by multiplying total real score of parameter with 10 and dividing the result by the maximum score of parameter.

$$PI = \frac{Total\ Riil\ Score\ of\ Parameter}{Maximum\ Score\ of\ Parameter} x10 \quad (1)$$

From the calculation of the index, it will be obtained awareness index which then can be categorised based on the detail in Table 1.

Table1.Category of awareness index [11]

Nr.	Index score	Category
1	80-100	Very ready
2	65-79	Ready
3	55-64	Almost ready
4	40-54	Less ready
5	0-39	Not ready

The determination of cognitive intervention was varied according to the characteristic of the residents in the each of district that obtained from the result of the survey [9].

3 Methods

This research was conducted in Manyaran and Kembang Arum district of Semarang city. The sample in this study were 40 people for each area aged ≥ 17 years, illiteracy and the board of neighbourhood (RT) or Hamlet (RW), and Family Welfare Programmed (PKK) cadres thereby contributing to disseminate information to the other resident. The sampling technique in this research is purposive sampling or judgmental sampling.

This study has four independent variables; they were Knowledge and Attitude (KA), Emergency Planning (EP), Warning System (WS), and Resources Mobilization (MR) from LIPI-UNESCO/ISDR [14]. The dependent variable in this study is the index of awareness of residents to landslides. Detail of variables used in the questionnaire of landslide preparedness index can be seen in Table 2.

The cognitive intervention implemented in this study was designed using the result of previous study [9]. Manyaran district was identifiedas an area with insufficient knowledge and information of landslide occurrences and by doing so, module, video and discussion were utilised to improve the awareness index. Kembang Arum has different characteristic of residents. It described as a prone area to landslides disaster and the area is often used as a place of research on landslide disaster. Therefore, the comprehension level of the residents regarding the landslide was highly expected. However, based on the previous result, it is found that the preparedness index of the residents is in the low level [8]. It requires different model of cognitive intervention such as poster rather than a module. Besides, video and discussion were utilised to strengthen the residents comprehension as well. The model can be seen in Figure 1.

The analysis of cognitive intervention is conducted by considering the pretest and posttest results so that the most effective cognitive intervention can be seen based on the difference in the increase of residents' preparedness.

Table2. Variables of preparedness index in landslide occurrences

| PARAMETER	VARIABLE	INDICATOR
Knowledge and attitudes	Natural events and disasters (type, source, quantity, location)	Explain the condition of disaster prone areas
		Understanding of the disaster
		The extent of the disaster
		Explaining the impact
		Explaining the scale of the disaster
		Explaining the signs of the disaster
		Explaining the source of the landslide
	Physical vulnerability	Explains the vulnerability of communities to natural disasters
	Attitude when the landslide occurred	Describes the self-rescue measures in time of disaster
		Describes rescue action during a disaster
Plan for emergencies	Disaster preparedness	Preparedness against disasters
		Preparation for disaster occurrences
	Evacuation plans	The availability of escape destination
		Availability of hazard maps
		Availability of evacuation maps, route/lane
		Availability of signs alarm
		Understanding of self-preservation procedures
	Identification of emergencies	Weather information
		Availability of basic observation facilities disasters
Disaster warning system	Disaster warning systems that traditionally evolved/ heredity applied and/or local agreements	Warning system agreed
		the level of understanding
		the effectiveness of the warning system
Resource Mobilization	Resource Mobilization	Understanding resource mobilization
		Resource mobilization activities
		the effectiveness of conducted resource mobilization done
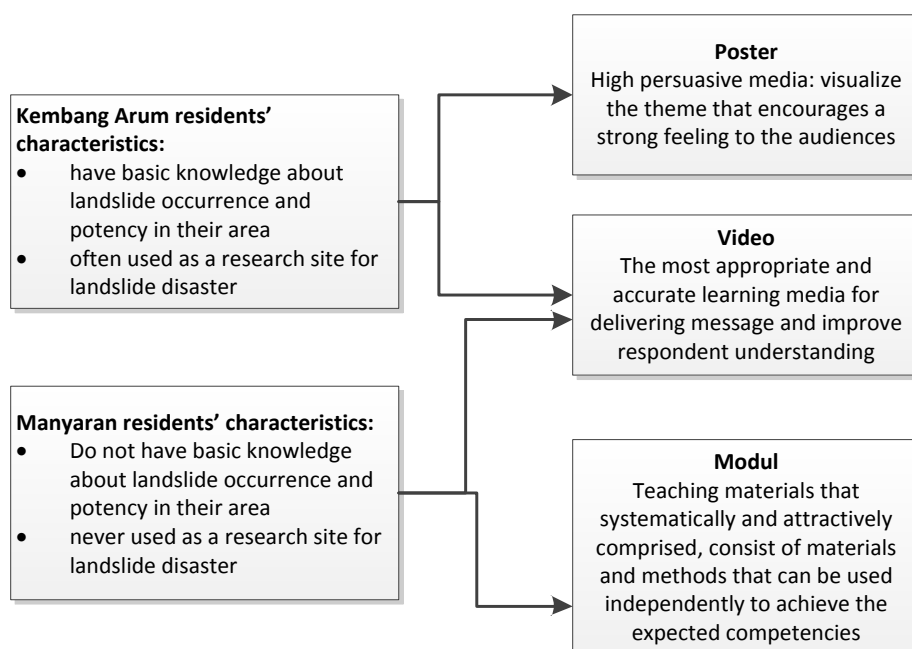
Fig 1. Design of cognitive intervention

4 Result and Discussion

Respondents in Kembang Arum sub-district are 40 people who live in RW IX, RW X, and RW XI. Selection of RW and RT was based on Arum Kembang Arum 2016 data and recommendation from Head of Kembang Arum sub-district. District Disaster Awareness (KSB) formed by BPBD Semarang City in Kembang Arum sub-district is less well run and less active, so the KSB should not be able to disseminate information about landslide disaster that exists in its territory to other residents. Lack of resource mobilization undertaken and activities aimed at improving landslide disaster preparedness are rare. In addition, Kembang Arum is often used as a research site for landslide disaster, so residents already know that the area is prone to landslide disaster. Respondents in Manyaransub-district are 40 people who live in RW V, RW VI, RW IX. Selection of RW and RT was based on Manyaran 2016 data and recommendation from Head of Manyaransub-district. District Disaster Awareness (KSB) formed by BPBD Semarang City in Manyaransub-district is less well run and less active, so the KSB should not be able to disseminate information about landslide disaster that exists in its territory to other citizens. The residents in Manyaran have a low understanding and comprehension regarding the condition of the prone area.

The pretest stage was carried out to find out the index of preparedness of Kembang Arum and Manyaran before implementing the cognitive intervention. The average pretest result regarding landslide disaster in Kembang Arum is 36.20 which is categorized as "Not

Ready". The average pretest result of residents preparedness index against the landslide disaster in Manyaran is 32.20 which is categorized as "Not Ready". The detail can be seen in Figures 2 and 3.

The result of qualitative analysis from FTA showed that the causes of low score of plan for emergencies in Manyaran district were of these events:

- Lack of the preparedness against landslides
- The absence of a landslide hazard map
- The absence of agreement about the escape destination
- The absence of the signs of landslides prone pins
- The absence of evacuation route
- The absence of observation facilities for landslides
- Lack of awareness from the district official about the landslide
- Less active of District Disaster Awareness (KSB).

Undevelopment Event consisting of the absence of landslide disaster observation facility and less active District Disaster Awareness (KSB). Designing the cognitive intervention is conducted by emphasizing the Basic Event because Undevelopment Event is a certain failure event that can not be found its cause and the incident is not quite related to the research undertaken. The result of qualitative analysis from FTA that explain the causes of low score of plan for emergencies in Manyaran was studied by Susanto et al. [9].
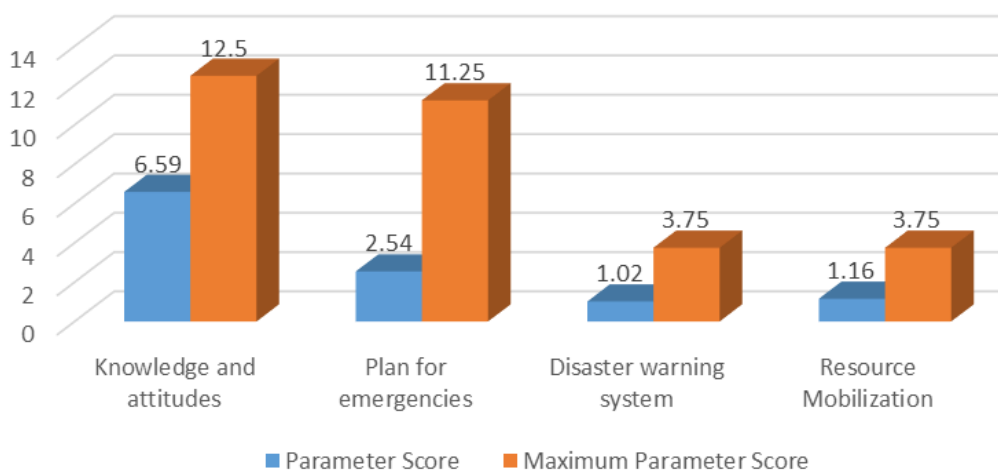

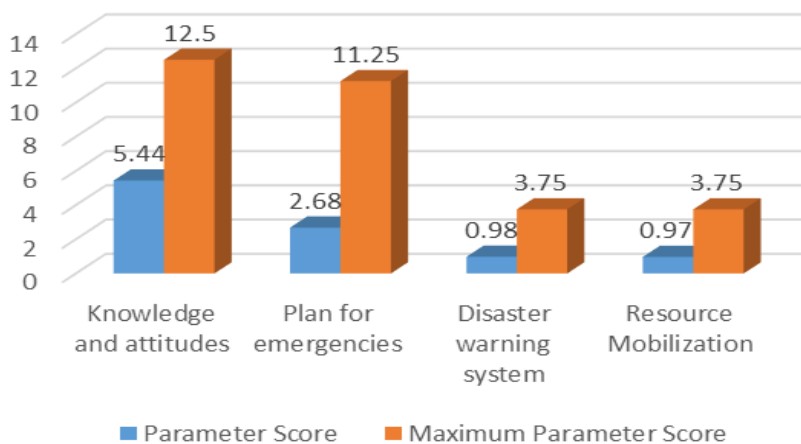**Fig. 2.** Pretest result for each parameter of preparedness index in Kembang Arum

Fig. 3. Pretest result for each parameter of preparedness index in Manyaran

The poster used for cognitive intervention consists of three posters of different materials. The material was decided based on Fault Tree Analysis analysis of the low plan for emergency in Kembang Arum. The posterwas expected can provide more understanding to the residents of Kembang Arum than the module, because the residents of Kembang Arum have a basic knowledge about landslide disaster from the counselling held from BPBD and research conducted in the sub-district. The poster provided includes four parameters of the preparedness index but more emphasized on the plan parameters for emergencies.

The module provided includes basic information covering the material that became the Basic Event of Fault Tree Analysis and the index parameters of landslide disaster preparedness. It also includes short comics about the importance of residents' awareness of the landslide. Manyaransub-district has residents with the lack understanding of the prone area. It related to the lack of information about landslide from sub-district government and KSB. The module is applied to Manyaran with the aim to obtain basic information about landslide disaster and optimize the delivered information.

The selection of cognitive intervention media using video is based on are commendation from Regional Disaster Management Agency (BPBD) Semarang City which suggest making a video about landslide disaster as media of socialization and delivery of information about landslide disaster to the residents in the prone area. The discussion that was held on cognitive intervention to the residents in Kembang Arum was started by giving discussion material with slide show media from apower point. The use of slide show media aims to provide more information and maximize the implementation of the cognitive intervention.

Posttest is conducted by using the same questionnaire that is a Likert scale questionnaire. Manyaran and Kembang Arum were given different treatment according to the characteristic of the residents. The result of posttest average in the form of preparedness index against landslide disaster in Kembang Arum is 62.16 which is included in the category of "Almost Ready". The detail can be found in Figure 4. The posttest result in the form of citizens' preparedness index against the landslide disaster in Manyaran is equal to 61.20 which is included in the category "Almost Ready". The detail can be found in Figure 5.
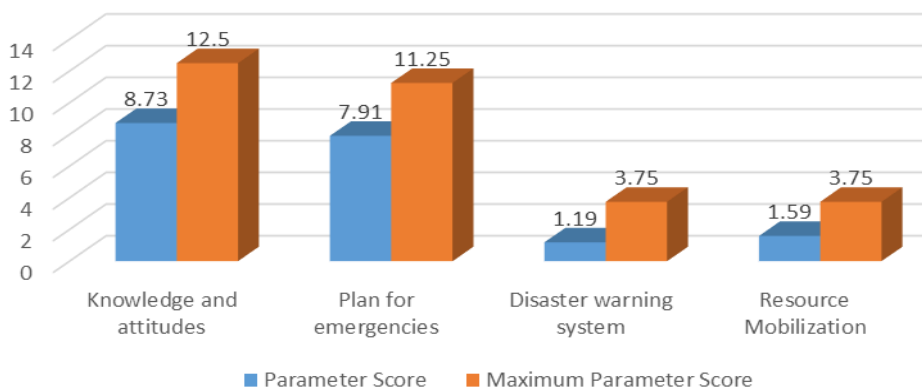

Fig. 4. Posttest result for each parameter of preparedness index in Kembang Arum
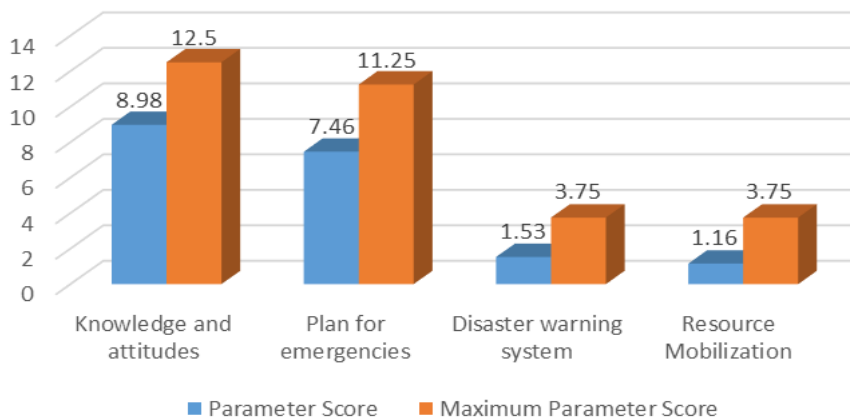
Fig. 5. Posttest result for each parameter of preparedness index in Manyaran

The increases in the index of preparedness in Kembang Arum and Manyaran after the implementation of cognitive intervention are expected to increase the awareness and preparation to face landslide disaster and reduce losses caused by landslide disaster.

The result of a comparison test of pretest and posttest of Kembang Arum and Manyaran by using Paired T-Test is <0,05, so there is an influence of cognitive intervention in preparedness index to landslide disaster.

The provision of modules and posters were distinguished between Manyaran and Kembang Arum to evaluate the effectiveness level between cognitive interventions. Differences in the results of cognitive intervention implementation in Kembang Arum and Manyaran can be seen from the improvement of resident preparedness index to landslide disaster before (pretest) and after the intervention (posttest). Kembang Arum with the media of cognitive intervention in the form of posters, videos and discussions has been increased the index of preparedness to the landslide disaster of 25.96points from pretest index 36.20 to 62.16 at posttest value. Manyaran with the media of cognitive intervention in the form of module, video and discussion have an increase of preparedness index to landslide disaster by 29 points from pretest index value 32.20 to 61.20 at posttest value.

The difference in the increase of citizens' preparedness index to the landslide disaster shows the effectiveness of different cognitive interventions in both sub-districts. Implementation of cognitive interventions with media modules, videos and discussions are more effective than cognitive interventions using poster media, video and discussion. This can be an input for the BPBD Semarang to carry out socialization about of landslide disaster in the city of Semarang. Table 3 describes the general analysis of results from this study.

5 Conclusion and further studies

The design of cognitive intervention in the landslide areas applied in each sub-district has a different approach depending on the characteristics of the residents. Residents in Kembang Arum already know the area is prone to landslide disaster and often used as a place of research on landslide disaster, so the cognitive intervention was given in the form of posters, video, and discussion. Manyaran has characteristics of the people who do not know the area is prone to landslide disaster. Therefore, the intervention was given in the form of module, video, and discussion.

Kembang Arum with the implementation of cognitive intervention media in the form of posters, videos and discussions has increased the index of preparedness to landslide disaster by 25.96 (71.71%) from the pretest value of preparedness index to landslide disaster 36.20 to 62.16 at posttest value.

Table 3. Intervention cognitive for residents in landslide areas.

	Study Areas	
	Kembang Arum	**Manyaran**
Characteristic	-Prone area of landslide -Residents know the area is prone to landslides -Often used as a place of research on landslides	-Prone area of landslide -Residents did not know the area is prone to landslides -There is no extension activity about landslides
Intervention media	Poster, video, discussion	Modul, video, discussion
Pre-test	36.20 (Not ready)	32.20 (Not ready)
Pos-test	62.16 (Almost ready)	61.20 (Almost ready)
Increasing	71.71 %	90.06 %

Manyaran with the implementation of cognitive intervention media in the form of modules, videos and discussions have increased the index of preparedness to landslide disaster by 29 (90.06%) from pretest grade of preparedness index to landslide disaster is 32.20 to 61,20 at posttest. The difference in the increase of preparedness index to the landslide disaster shows the effectiveness of different cognitive interventions in both areas. So it can be concluded that the implementation of cognitive intervention with module media, video and discussion in Manyaran is more effective than cognitive intervention using poster media, video and discussion at Kembang Arum.

Based on the conclusions, the following suggestions are given: further research should be focused on other stakeholders in disaster management such as the government and government institutions (BPBD Semarang City). This follow-up study aims to measure the level of preparedness of government and agency BPBD because both directly contribute to the index of preparedness. Further research on collaborative design among stakeholders is needed to improve the overall preparedness index for landslide disaster.

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