Rethinking local genius of the Merapi’s community in eruption disaster risk reduction. Does it still work?

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Abstract. Merapi Volcano in Central Java which has a high level of activity still holds hazard potential in the future. To reduce the disaster risks, a good disaster management is required. People who live in hazardous areas possess important social capital to enhance disaster management, in the form of local genius to cope with eruption. However, a question arises whether local genius still exists and is accepted by members of the younger generation. This paper presents a discussion about the existence of local genius on the younger generation in the southwest region of Merapi Volcano. The data were collected using some techniques which include interviews, focus group discussions, and literature study. The data were analyzed descriptively supported with scoring and statistical analysis. The results of the study show that local genius is not widely recognized and understood by the younger generation. There are no differences on the understanding of local genius among young members of the society who differ in age. The lack of teaching about local genius between generations causes a low understanding of young generation on local genius. Despite having a high motivation for preserving local genius, the younger generation perceive the local genius as a socio-cultural asset rather than as a source which enhances a disaster management. Overall, this paper presents new insights to understand the existence of local genius among the younger generation.

1. Introduction

The natural disasters caused by volcanic eruptions still pose a threat to the lives and livelihoods of the population in Indonesia till the present time. A study conducted by the Indonesian National Disaster Management Agency [1] shows that the risk of a volcanic eruption disaster in Indonesia is exposed to no less than 2,396,761 residents that spread across all provinces in Indonesia, which offers a potential loss of up to Rp 13.6 trillion. In the historical time range, volcanic eruptions are included in the natural disasters which cause great losses and fatalities. This condition correlates with the number of active volcanoes in Indonesia which account for 13% of the active volcanoes in the world [2], while the high density population occupancy in volcanic areas has been running for thousands of years [3]. With regard to this, attention and studies pertaining future eruption disaster risk are still relevant to be carried out.

Merapi Volcano located in the Central Java is one of the most active volcanoes in the world [4], indicated by a short eruption period of between 1 and 7 years and a large eruption of every 15 years [5]. With this characteristic, it poses great negative impacts for the population. Based on the data from the Indonesian National Disaster Management Agency [6], Merapi Volcano eruption at a scale of VEI-4 in 2010 caused a total loss of Rp 3.62 trillion and 386 people's deaths. Therefore, to reduce the disaster risks caused by the Merapi Volcano eruption, a good disaster management is required. Local genius that
grow as a result of the interaction of the community with its environment for a long time [7] becomes an important social capital to enhance the disaster management. Previous studies show that there are various forms of local genius pertaining to the introduction and management of disasters in the area of Merapi [3], [7] - [9].

Local genius to deal with the eruption disaster can be a social cultural asset of the community and support the implementation of disaster management. In this regard, the question that arises is how the existence of local genius among the current millennial generation. In the modern era today, the existence of local genius is likely to be displaced by the advancement of information technology. Local genius may still exist, but its effectiveness in handling eruption disasters needs to be reviewed. In addition, it is also necessary to know how the role of local genius as one of the references to deal with Merapi eruption amid the information disclosure from various sources that can be easily accessed by people in disaster prone areas.

This paper attempts to provide alternative information about the existence of local genius to cope with disasters among the younger generation. More specifically, the research area is limited to the southwestern part of Vulkan Merapi to further explore previous studies conducted by Setyawati et al [7] and Septiana et al [9]. There are two more specific aspects discussed in this paper. First, we illustrate the understanding and perception of the young generation on the local genius of the community in dealing with the eruption disaster. Second, we discuss how the position of disaster local genius at this time.

2. Methods

This research builds on previous research which shows the existence of local genius to cope with the eruption disaster in the southwest slope area of Merapi Volcano. In this research, a thorough discussion on how the existence of local genius among the younger generation is presented. The collected data includes the understanding and perception of the younger generation on local genius. Data collection was carried out by employing some techniques namely, focus group discussions, interviews, and literature studies. The sampling was conducted randomly on members of the community aged 18 to 40 years from the seven villages in the District of Srumbung. The selected seven villages are included in the eruption-prone areas, namely Kaliurang, Kemiren, Ngablak, Srumbung, Mranggen, Ngargasoka, and Tegalrandu village. In the previous study, Setyawati et al. [7] identified young generation's understanding on local genius in three villages namely Mranggen, Ngargasoka, and Tegalrandu. Some of these research results also become sources of data to support this research.

The collected data were then analyzed descriptively which was supported with scoring and statistical analysis. The descriptive analysis was carried out to provide detail descriptions about various types of local genius in dealing with catastrophic eruptions and the understanding and perception among the younger generation. Scoring analysis was performed to determine the extent of understanding and acceptance of local genius (Table 1). The higher the obtained score is, the better the understanding and the acceptance of local genius will be. In addition, a statistical analysis was employed as a follow up of the scoring analysis which intended to get more information about the variations on the existence of local genius in different age group. In the statistical analysis, we tested whether there are differences of mean score that represent the existence of local genius, between respondents at the age of 20s and 30s. The analysis was conducted by employing t test using SPSS and calculated with eq 1 and eq 2 [10]. In addition, we also tested whether age influences the understanding and acceptance of local genius. The analysis was performed by utilizing simple linear regression using Microsoft Excel.

| No | Aspects assessed | Indicators and scores | Score 1 | Score 2 | Score 3 |
|----|------------------|-----------------------|---------|---------|---------|
| 1  | Knowledge on the existence of various forms of local genius in dealing with disasters | Don’t know | Know little bit | Know thoroughly |
3. Results and Discussions

3.1. Interviews and focus group discussions with respondents

The interviews were conducted in six villages which geomorphologically are located in the southwestern flank of Merapi Volcano. The selection of research location is based on the research objectives, namely to follow-up the previous research findings conducted by Setyawati et al [7] and Septiana et al [9] who investigated the local genius in dealing with eruptions in the region. The six villages consist of Kaliurang, Kemiren, Ngablak, Srumbung, Ngarga Soka, and Tegalrandu, which are administratively included in Srumbung District, Magelang Regency, Central Java. The history of Merapi eruption indicates that this area was greatly affected by eruptions in the past [4], [5], [11, [12], [13]. The interaction between community life and the eruption that repeatedly occurred in this region also contributes to the development of local genius in dealing with eruption disaster.

Sixty interviews were already conducted. The respondents interviewed in this research include community members aged 18 to 40 years (Figure 1) residing in the six villages. In the interview process, the questions have been prepared covering several aspects related to the introduction and understanding of local genius, the teaching of local genius that has been experienced, and the motivation to participate in the preservation of local genius (Table 2). The questions in the interview are open, so that respondents can freely and broadly give answers, instead of only depending on the guiding question. Interviews were conducted in Bahasa Indonesia and the results were filled in the interviews guide.
Figure 1. Boxplot for respondent’s age

Table 2. Questions asked during semi-structured interviews

| Variable                                      | Questions                                                                 |
|-----------------------------------------------|---------------------------------------------------------------------------|
| Socio-demographic                             | Question about personal details which include name, address, age, occupation, and education |
| Knowledge about local genius                  | What do you know about the advices, teachings, habits, or myths of the predecessors in dealing with the eruption of Merapi? |
| Understanding on the meaning of local genius  | What is the meaning of advices, teachings, habits, or myths about the Merapi eruption disaster? |
|                                              | What are the objectives and expected actions of the various forms of local genius? |
| The teaching on local genius which has ever been experienced | How do you know about these various forms of local genius? are they taught directly or do you obtain information from daily life in the community? |
|                                              | Who usually shares information about local genius in dealing with disasters? |
| The benefits offered by the local genius in disaster management | What are the benefits of local genius for dealing with the Merapi eruption disaster? |
| Motivation in preserving local genius         | What roles will you play as a young generation to preserve local genius? |
| Involvement in the preservation of local genius | What are your activities and how have you carried out your activities in preserving the local genius? |

Beside interviews, we also conducted focus group discussions which involve community members of 18-40 years old from the six villages. In the focus group discussion, various aspects pertaining to the existence of local genius among young people, as asked in the interview, were discussed. The focus group discussion allowed participants to perform broader and deeper discussion, where participants carry out mutually supportive interaction, mutually correcting, and compare experiences with each other. The information obtained from focus group discussions becomes another reference to discuss issues other than information obtained from the interviews. In addition, information from interviews, focus group discussions, and literature reviews is complementary and corrective.
3.2. The existence of local genius among the younger generation

Various earlier studies have explained that local genius pertaining to the introduction and efforts to deal with eruption disasters exist in the area around Mount Merapi. Local genius consists of spiritual beliefs, myths, including people’s behavior in dealing with catastrophic eruptions [3], [8]. Specifically in the southwest slope area of Merapi Volcano, Setyawati et al [7] in her research explain that there are various forms of local genius conveyed in communication between communities. They consist of cultural semiotics, vegetal semiotics, faunal semiotics and physical semiotics. Cultural semiotics are teachings, advice, guidance, and even myths related to Merapi’s volcanic activity and efforts to avoid its dangers. Vegetal semiotics include signs of vegetation which indicate that eruptions will occur. Faunal semiotics are in the form of animal behavior that stay away from Merapi Volcano as an indicator of eruption. Meanwhile, physical semiotics are physical symptoms that exist before the eruption including high air temperatures and rumbling that originates from Merapi Volcano.

Many different local genius have become a guideline in the society for a long time, especially in the past when an access to information was limited. Septiana et al [9] explain that the teaching on local genius is also carried out in the community. There are several methods of teaching local genius to the younger generations, namely through behavior, traditional activity, oral stories, community associations, and gethok tular or word of mouth between community members. However, it seems that the inheritance of local genius to young generation today is not very effective. This is proven by the research of Setyawati et al [7] carried out in the villages of Mranggen, Ngargosoka, and Tegalrandu which show that local genius is only understood by one third of the young generation in the region. The next third only hears information about local genius without having understanding, while another third never even hears about the existence of local genius.

In a further investigation that we conducted in the six villages on the southwest slopes of Merapi Volcano, we found that there were no significant variations on the understanding of local genius in the younger generation. This is based on the scoring of the six aspects related to the understanding of local genius (Table 1) where the results show a fairly large grouping of mean score between 10 and 14. The scoring results show a range of score between 7 to 17 without low scores i.e scores between zero up to six (Figure 2). The aspects that contribute to a lot of high score is the benefits of local genius. The younger generation generally perceive that local genius is useful as sources of information in the introduction of the eruption disaster and its handling. However, the younger generation keeps referring to the official information delivered by government agencies and perceive local genius as an additional reference in the context of socio-cultural assets. In the focus group discussions, some even expressed their opinion that the use of local genius was considered a setback in the context of information seeking, since accurate sources of information could be easily accessed at this time.

The aspect that contribute to many low scores is an understanding of local genius. Many young people have heard various information about different forms of local genius, but they do not understand the meaning behind the information. Local genius is often implicitly taught through stories, advice, or myths. The lack of systematic learning between generations becomes a factor that influences the low understanding of these various types of local genius. In this regard, some received direct teaching on local genius through advice and exemplary behavior, habits, and culture. Meanwhile, many younger generation know local genius from gethok tular (word of mouth).
An interesting question to further explore is: is the acquisition of local genius in the younger generation influenced by one's age? The higher of one's age should enable them to gain more teaching and experience related to local genius. In this research, we involved respondents aged 18 to 40 years. These respondents can simply be grouped into two different generations, 20s and 30s generation. To examine the differences on the acquisition of local genius between generations, we conducted a different test on the mean of scoring results for the aspects of local genius acquisition in the two groups of generations. Since the median age of the respondent is 28 years, the first age group is 18 to 28 years and the second group is 29 to 40 years. The results of the scoring in each age group are presented in Table 3.

![Boxplot](image)

**Figure 2.** Boxplot of representation score of the understanding on local genius

The following table presents the scores of local genius representation in different age groups:

| Age Group | N  | Mean | Median | SD  | Max | Min |
|-----------|----|------|--------|-----|-----|-----|
| Under 28  | 31 | 11.61| 13     | 2.70| 16  | 7   |
| Upper 28  | 29 | 12.45| 13     | 2.16| 17  | 9   |
| Total     | 60 | 12.02| 13     | 2.47| 17  | 7   |

The results of the different test analysis show that there was no significant difference between the mean scores of the generation in their 20s and 30s. The calculation using eq 1 and eq 2 get a t score of 1.33 with a degree of freedom 20. The t value is at a significance level of 0.05 greater than the critical value. Meanwhile, the results of the independent t-test analysis using SPSS showed a sig value of 0.194 which was greater than 0.05. Both of these results indicate that there is no difference in the mean score that represents the acquisition of local genius of the 20s to 30s age group.

A simple linear regression analysis shows that age has a positive effect on the acquisition of local genius by young people. But, this effect is very small as indicated by the R2 value of 0.07 with the equation \( y = 0.0906x + 9.3637 \). This shows that age hardly ever influences the one's acquisition of local genius. This is also in accordance with the results of the independent sample t test which indicates that there is no difference in the acquisition of local genius by young community members of different age. The lack of local genius teaching from the previous generation and the ease of information seeking have driven the low acquisition of local genius by young people aged 18 to 40 years. The higher age does not have an effect because the values of local genius have long been ignored. For young generation, local genius is often perceived as a myth that cannot be used as an accurate reference for dealing with disasters.
The low understanding of the younger generation on local genius is partly due to the assumption that local genius is ancient. As we found in the focus group discussion, respondents say that local genius is a back step in the current era of life. This assumption is indeed commonly found, as explained by Lan [14] that local genius is considered backward. The ease of information access, the advancement in education levels, and the various forms of modernization that occur in the southwest slopes of Merapi become factors that contribute to the lack of understanding and trust in local genius among the younger generation. This condition is in accordance Ford et al [15] stating that local genius is influenced by the rapid environmental changes and the modernization which include the access to formal schools. The rapid environmental changes have caused local genius such as traditional observations and forecasting become inaccurate. Meanwhile, modernization may change livelihoods, weaken traditional institutions, and reduce communication between generations.

The delivery of information about local genius to the younger generation can be performed by teaching, explaining, and transferring knowledge and experience. This can be optimized by utilizing social media such as Facebook, Line, YouTube video clips [21]. The use of social media to convey information to the younger generation has a strategic role because the younger generation in the current era uses more social media than traditional media to communicate, seek information, exchange experiences, learn and so on.

The use of social media to convey information to the younger generation offers various advantages such as social media enable quick information delivery, allow users to modify messages to be more interesting for example by combining text and images, and overcome barriers of space and time. In this regard, the older generation needs to have media literacy so that they can optimally pass on the values of local genius to the younger generation.

3.3. The current function of local genius: disaster management and / or socio-cultural assets?

The question that needs to be addressed about the local genius existed in the southwest slope area of Merapi Volcano at this time is: Is the local genius still relevant to be used as a reference to deal with disasters? When viewed from the content and meaning of various types of local genius, it is still relevant as one of the references in recognizing and facing eruption disasters. But, the problem now is that the knowledge of the younger generation and intergenerational teaching on local genius is inadequate. Parties that have sufficient knowledge and understanding often do not position local genius formally. Talks related to local genius are only limited to oral stories, which is slightly delivered, for example when there is an increase in Merapi volcanic activity.

Although many young people are motivated to learn and preserve (in Javanese: nguri-nguri) the local genius, but many do not trust information or actions that originate from local genius in today’s era. Moreover, local genius is often perceived as myths (part of cultural semiotics), causing a lack of attention from the younger generation. In fact, in addition to cultural semiotics, there are faunal semiotics, vegetal semiotics and physical semiotics in the form of introducing natural signs related to the volcanic activity of Merapi. In our focus group discussion, young people at the 20s and 30s agreed that local genius can be an additional source of information for local people along with official information and direction given by the government. For example, the government shares information about the increased volcanic activity of Merapi, on the other hand the community identify the physical symptoms of eruption such as an increase of air temperature or rumbling (physical semiotics) and wild animals which move to the settlements (faunal semiotics). This information is expected to increase people’s alert on the disaster that may occur. In line with this idea, an experience in Bangladesh [16] proves that local genius combined with western-euro-centric scientific knowledge is proven to improve the community resilience to cope with flood. Based on this experience, the community resilience can be realized by combining the benefits of indigenous knowledge with modern technological solutions.

The efforts to integrate indigenous knowledge with official government policies in disaster management has become a global thought. In the Philippines [17], for example, indigenous people participate in managing the Typhoon Haiyan disaster by employing innovative methods that integrate local genius in the programs they carried out. Here, the elderly even dedicates special activities to ensure
the transmission and preservation of their local genius to the younger member of their community. However, on a national scale, formal efforts have not yet been made to realize such integration, for example in a product of law. Compared to the experience in the Philippines, the implementation of local genius in the southwest region of Merapi is lower. Meanwhile in Japan [18], studies were carried out on the architecture of ancient cities which from time to time survived various catastrophic events. Strong traditional knowledge is used to support the application of disaster mitigation methods in modern architectural designs. Furthermore, this knowledge is passed on to future generations. Learning from the experience in Japan, the local genius of the Merapi community also needs to be integrated with modern disaster management to function in local scale disaster management in the region. Meanwhile in China, the exploration of ancient wisdom and the use of ideas from ancestors is useful in helping to find more effective and efficient strategies for managing stormwater in urban areas [19].

The idea of combining local genius with modern science has been widely practiced. Local genius which is combined with scientific knowledge can be a great resource to navigate the changing world of people's lives [14]. For example, in a climate change adaptation strategy, the integration of unique and specific indigenous knowledge can be one of the best ways to implement a more effective and sustainable climate change adaptation strategy in the community [20]. Why is local genius important to support scientific knowledge? Ford et al [15] say that local genius is proven to be a major source of resilience and become a repository of the accumulated experience.

Apart from its role in supporting disaster management that is still debatable among the younger generation, the local genius is basically a socio-cultural asset and part of the culture of the Javanese people. The content delivered is also the result of community interaction with the physical environment where they live for a long time. As a socio cultural asset, further teaching and efforts to preserve various aspects of local genius are very important to be realized. Research related to local genius has also been carried out. If the introduction and preservation of local genius is performed, an effective communication strategy is required to convey information to the younger generation.

4. Conclusions
Local genius in the form of introduction and adaptation to the potential eruption hazards has long been developing in the southwest slope communities of Merapi Volcano. In the past, this local genius became an important reference for the community in disaster risk reduction. However, in the modern era, the knowledge and understanding of the younger generation on local genius is quite low. This is found in community members aged 18 to 40 years. In this case, the higher age doesn't guarantee of better understanding of local genius. This condition occurs due to the lack of teaching from members of the old community to the younger generation. The lack of teaching certainly affects the perception of the younger generation of the local genius as a reference in disaster management in the region. Information sourced from the local genius is often perceived as inaccurate. However, the younger generation actually has a high motivation in preserving the local genius as one of the socio-cultural assets of the people in the region. This allows the integration of local genius with the official disaster management policies from the government sourced from scientific studies.

For evaluation process, this research is limited to the understanding of local genius of the community members based on age groups. There are several things that need to be carried out in further research, including the understanding of local genius based on the level of education, gender, and the perception of the younger generation on the function of local genius in disaster management. Future research is recommended to develop a model of integration between local genius and official disaster management from the government.

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