Learning of disaster mitigation through problem based learning method in senior high school

I S Azis*, D Sugandi, I Setiawan

Department of Geography Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
*Ikbalasafulazis@gmail.com

ABSTRACT. In Indonesia, disaster education in schools is now very necessary because of Indonesia's geographical location which is in the ring of fire. However, learning activities in the classroom appear to be passive because the teacher's role tends to be most dominant while the role of students is limited. Learning will be more effective when students are more directly involved than just passively accepting material from the teacher. The purpose of this study was to determine the application of Disaster Mitigation Learning Through Problem Based Learning Methods in High Schools. The method in this research is the study of literature. Problem Based Learning (PBL) is a method characterized by utilizing problems that occur in the real world to train students to think critically and skillfully in solving problems. Disaster mitigation that prioritizes phenomena around students will provide comprehensive knowledge. Therefore, material content that prioritizes phenomena will be suitable if taught using problem-based learning methods because students are expected to be problem solvers related to disasters.

1. Introduction
Disaster education in Indonesia is a very important thing because Indonesia is a disaster-prone country. This disaster originated from volcanic eruptions, earthquakes, tsunamis, floods and landslides. Disaster is an event or series of events that threaten and disrupts people’s lives because of natural factors and/or human factors resulting in fatalities, environmental damage, property losses, and psychological impacts. Disaster is a combination of factors that determine the potential for people to be exposed to certain types of natural hazards [1].

Disasters can be understood as events or series of events caused by nature, humans and/or both that result in victims of human suffering, loss of property, environmental damage, infrastructure and public facilities damage and causing disruption to the living arrangements and livelihoods [2]. In that context, the concept of risk has been evolving during the last five decades, and risk models have extended from being hazard-dependent to including other components, e.g., vulnerability, exposure, and capacity [3].

Risk can be formulated as a result of the potentially damaging phenomenon (i.e., the hazard component) and the degree of susceptibility of the exposed elements [4]. The recent concept of vulnerability highlighted inverse proportionality between the susceptibility and the development of a community [4]. Vulnerability is composed of the following four aspects:
- the physical factor, often determined by material characteristics of the concerned assets, e.g., population density and buildings properties
- the social factor, measured through the extent of well-being
- the economic factor, retrieved from the economic status
• the environmental factor, deduced from the level of resource depletion in a society. Moreover, the impact of a disaster.

Hazardous events are distinctive by type, intensity, frequency, and impact on the elements at risk. Moreover, each hazard type has a specific magnitude unit related to the amount of energy released during its physical process [5].

The impact of environmental damage must be known and understood by people, therefore, education should include the preservation of the environment in a learning and teaching process [6]. Disaster phenomenon is the phenomenon of geophysical or biology that was involved in several ways as the trigger phenomena or links in a chain of causes. However, when that natural hazards appear to be directly related to the loss of life and property damages, there are also social factors that involved and causing vulnerability of community and sometimes can be retraced until the ‘bottom causes’ and general causes. This vulnerability is resulted by process of social, economic, and politics that influence how hazards affect people in various ways and with different intensity [1].

| Types of Disaster | Impacted | Victim Dies (People) | School Damage |
|-------------------|----------|----------------------|---------------|
| Earthquake        | 2,906,647| 8,324                | 20,970        |
| Flood             | 17,283,349| 2,013               | 5,170         |
| Volcano           | 308,762  | 427                  | 617           |
| Landslide         | 85,081   | 1,673                | 9             |

Source: BNPB 2014

Disaster education must begin from an early age. It is based on the fact that every year was estimated at around 66 million children around the world affected by the impact of disaster [7]. It is because they have limited ability and resources to control and prepare themselves when feeling scared so they highly depend on other parties to recover from disaster [7] [8]. Furthermore, the study areas are often subject to several types of risks (e.g., earthquakes, floods).

Disaster education in elementary and middle schools are helping children to play an important role in life rescuing and protecting community member [9]. The gradual shift in people’s perception from being reactive to proactive in the face of disaster is the prominent lesson learned by experience for the attainment of sustainable development [10].

The quake size is measured with a moment magnitude scale, while floods are measured using the discharge scale in m$^3$/s. The historical archives on the features of previous hazards give a better understanding of the phenomena and enable predictions about hazard intensity and the likelihood of a hazard’s occurrence. Finally, human activities affect the natural system by increasing the environmental degradations that significantly change the conditions related to hydrometeorological natural hazards and consequently limit the efficiency of forecasting models [11].

The lesson of disaster mitigation in school is limited to a short material with only 4 class meeting. In addition, it was also limited to majority of students who has not learned disaster mitigation because of no geography lesson in their classroom. These limitations are very contrary to the mandate of Constitution, whereas to input the topic of environmental damage in the teaching and learning process, sub-topics of environment and the impact of environmental damage, especially flood, must be included in the curriculum [6].

Learning would be more effective if the learner getting more involved directly than just passively receiving from a teacher. Experiential learning theory was describing the ideas of experience and reflection. Kolb has defined four of learning modus, there is: Concrete experience, reflective observation, abstract conceptualization [12]. Learning in the class is seems passive if teacher tends to be dominant while the role of students is very limited.
One of active learning method is Problem Based Learning (PBL) method, that is learning based on a problem which oriented to the student’s experience. In PBL, teacher and students altogether integrate various concept and skills from one or more knowledge fields to solve a problem [13].

As a learning method that focus on students, PBL has some characteristics, that is: using stimulus materials to help students in understanding the problem. The stimulus is presented as much as possible in the same context with what will be found in the real world, information on how to solve the problem is not given but the needed sources are provided, students working in small group or team with the help of a tutor although they are not the expert that related directly to the problem, they can facilitate the learning process, learning areas that needed are identified through the exists problem and learning resources of student, learning that has been occurred will be summarized and being integrated into a knowledge and skill that is new for students, students learn intensively with one problem of one period of certain time [14].

Based on the problem of disaster mitigation material that should be delivered entirely, because the current method that the teacher used is traditional method or lecture has some lack so it needs to use a better method. Therefore, this study is discussed the mitigation learning use Problem Based Learning method.

2. Methods

Research method is an important thing because the quality of research depends on the effective and fit method so it produces the exact answer for the problem that has formulated. Method is a way to conduct research depends on the problem characteristics that have been learning [15]. The method used in this research is literature study.

A literature study is research that conducted only based on written works include research results either has been published or not yet [16]. Although this is a research, study literature research does not need to go down to the field and meet the respondents.

The data that needed in this research can be obtained from library sources or documents. According to Zed [17], in library research, searching library sources is not only for the first step to prepare research design but also to utilize it for obtaining research data. Besides data, several things that must be included in research to be scientific needs other things like the formulation of problem, theoretical basis, data analysis, and taking a conclusion. Research with a literature study is a research that the prepare is same with other research but for the resources and collecting data method by collecting data in the library, read, take notes, and processing research material.

3. Results and Discussion

Learning in school is important to be created in a pleasant situation, it is stated by Johnson (2006) that pleasant learning is a fun and meaningful learning process. Fun means that learning can be enjoyed without any pressure, while meaningful means knowledge and skills which obtained by students can be useful for their life. Stated that Problem Based Learning (PBL) is a method that marked with the usage of a problem which exists in the real world to train students thinking critically and competent in solving a problem and obtain the knowledge of the important concept of the things they have learned [4]. PBL method makes the problem to encourage learning activity. Before learning some knowledge, students are given a problem to seek solving.

Problem Based Learning (PBL) is a learning method that based on problems, where the problem is used as stimulus to push students using their knowledge to formulate a hypothesis, seeking relevant information which is student-centered through discussion in a small group to gain the solution from the given problem [18].

As a learning method that focus on students, PBL has some characteristics, that is: using stimulus materials to help students in understanding the problem. The stimulus is presented as much as possible in the same context with what will be found in the real world, information on how to solve the problem is not given but the needed sources are provided, students working in small group or team with the help of a tutor although they are not the expert that related directly to the problem, they can
facilitate the learning process, learning areas that needed are identified through the exists problem and learning resources of student, learning that has been occurred will be summarized and being integrated into a knowledge and skill that is new for students, students learn intensively with one problem of one period of certain time [14].

As the statement of experts that Problem Based Learning is a method that went from a problem, so it can be used in learning disaster mitigation because the content is rooted in problems. In line with it, Stated that learning of environmental damage is related to knowledge, understanding, skill, and emotion of students [6]. Either teacher or lecturer are generally using a whiteboard, textbooks, and slide presentation in teaching and learning of flood. This kind of learning method is relatively easy to do, quick, and does not need much time. But, in this kind of learning, students was not involved emotionally and their understanding is only based on textbooks.

Learning of mitigation should be done by giving the knowledge emotionally that exists in the environment of students [6], and it is supported by statement of Arend, stated that PBL is a learning approach where students are facing the authentic problems so it was expected that they will arrange their own knowledges, develop the high level of skill and inquiry, making student independent, and increase their confidence [19].

But, in this learning method was also collides with the concept that students have not understood yet. Problem Based Learning concept eventually have to reach a solving process of problems that delivered at first according to the information that students have accepted and studied with their critical thinking as stated [20]. Problem Based Learning (PBL) is a series of learning activity emphasize in the process of problem-solving that faced scientifically. The essence of problem appointed in Problem Based Learning is a gap between the real situation with expected situation or between what happens with expectations. So, the position of students will be difficult to process their critical thinking to be a problem solving that makes learning to be ineffective.

Furthermore, in PBL method, students are required to critical thinking. Critical thinking is reasonable and reflective thinking that focused on determine what should be trusted and what should do. It means when using critical thinking is expected to determine precisely what to trust and what to do. Critical thinking is an intellectual process and full of skill concepts that is (1) applied; (2) analized; (3) synthesis; (4) evaluate the origin of an information; (5) or generalize the results of observation process, experience, reflection, reasoning, or communication as a foundation to be trusted [21].

Therefore, more active teacher’s role is needed to make students can speak their mind because oftentimes there was the ineffective situation as the impact of students who close themselves and does not want to involve to speak. While in Problem Based Learning as stated this method can push the students to be more open-minded, reflective skill, and critical and active learning [14]. During learning process in experiment, those things seem to rise. This is proven by the active learning process in class and creation of poster or paper with good quality in the class with PBL method.

Method of problem based learning that implemented in the lesson of disaster mitigation which aim to make students more active in thinking [14], and encourage them to be critical thinker [13], as stated when learning about problem in their environment, students will be more understood [6].

It is supported in the characteristics of Problem Based Learning process according to that is : 1) Problem is used as a beginning of learning. 2) Generally, a problem that used is the problem in the real-world that floated present 3) That problem is generally required compound perspective [22]. The solution is demand students to use and achieve concept from some knowledge that has been taught before or cross to another science field. 4) The problem makes the student feel challenged to get learning in the new learning realm. 5) Highly prioritize self-directed learning. 6) Utilize various knowledge resources, not from only one resource. 7) The learning is collaborative, communicative, and cooperative. Students work in a group, interact and peer teaching, and doing a presentation.

From the explanation, it could describe the stages of disaster mitigation learning using PBL method with stages of Problem Based Learning method implementation which consists of 5 process stage [20] that is :

1. **Problem Identification**: Identify the problem in the environment. This is done by gathering information about the problem, its cause, and its impact.
2. **Problem Analysis**: Analyze the problem to determine its root cause and possible solutions. This involves using critical thinking skills to evaluate data and information.
3. **Solution Development**: Develop solutions to the problem. This involves brainstorming, discussion, and collaboration among students.
4. **Solution Implementation**: Implement the chosen solution. This involves planning, executing, and monitoring the implementation process.
5. **Evaluation and Reflection**: Evaluate the effectiveness of the solution and reflect on the learning process. This involves assessing the outcomes of the solution and identifying areas for improvement.
• First stage, is a process of student’s orientation on the problem of disaster. In this stage, teacher explain the aims of learning, explain the needed logistics, motivate students to involve in the activity of submit a problem of disaster and problem solving of disaster mitigation.

• Second stage, organize students. In this stage, teacher split the students into groups, helps student to define various disaster phenomenon and organize learning tasks that related with disaster problem.

• Third stage, guide the research of individual or group. In this stage, teacher encourage students to collect the needed information, doing experiment and research to obtain the explanation and problem solving. In this stage student should also searching the image or video of process and the impact of disaster occurrence. Students was also required to critical thinking added with the explanation of disaster mitigation problem solving that should be done by several parties.

• Fourth stage, develop and present the results of discussion from the stage of interpret disaster, affected area so that would be a disaster mitigation. In this stage, teacher helps student in planning and preparing the report, documentation, or method and help them to distribute the task with their peers.

• Fifth stage, analyze and evaluate the process and results of problem solving. In this stage, teacher helps student to do reflection or evaluation on the process and research results that they have done.

Unraveling the explanation of Problem Based Learning method that prioritize current problems and exists in the environment around students become a compatibility basis of that method to be implemented in learning disaster mitigation. When learning disaster mitigation are designed to be fun and based on the problem around students as conducted in PBL method so the learning would be more meaningful or in other words will be more useful for students. As from the aim of disaster mitigation education to be one of the effort to increase knowledge capacity of students about disaster, types of disaster occurrence, indication of disaster occurrence, impact of disaster, effort of pre-disaster-post disaster, effort of reduction disaster risks and vulnerability of disaster in their area.

PBL that prioritize the problem as a beginning is highly suitable with the aim of learning disaster mitigation which has aim to be a provision of knowledge and life skill that student needs so when disaster occurs, student can do some effort of self rescue and can help other. Phenomenon that occur in their environment should become a lesson and provision of their life as stated that citizen of Indonesia should be equipped with knowledge of the hazards of natural disaster, starting from kids who is in kindergarten, elementary school, and soon, or even all related people, such as family or fishermen or farmer in the mountain. It is highly accomodate by Problem Based Learning (PBL) method that was the activity series of learning that prioritize in process of problem solving that faced scientifically according to, so the students are expected to be the problem solver of disaster that occurs in their environment.

4. Conclusion
The material of disaster mitigation this time is less delivered effectively as the impact of the learning method that makes the teacher as a learning centre so the students were not developed. Disaster mitigation that rich in the phenomenon in the environment around students can give extensive knowledge. So, material content that prioritizes phenomenon that occurs in surrounding environmental is suitable if it taught using Problem Based Learning method because, with this method, students will be equipped with problems that exist in their environment. Moreover, students also will be required to critical thinking in the effort of analyzing disaster, its impact and culminate to a solving of disaster mitigation problem.

References
[1] Wisner B et al 2004 At Risk: Natural Hazards, People’s Vulnerability, and Disasters, second
edition (London: Routledge)
[2] Tamin, O. Z. 1997. *Perencanaan dan Pemodelan Transportasi*. (Bandung: ITB)
[3] S B Miles and D K Keefer 2009 Evaluation of CAMEL comprehensive areal model of earthquake-induced landslides *Eng. Geology* vol 104, 1 pp 1–15
[4] J Hernantes, E Rich, A Laugé, L Labaka, and J M Sarriegi 2013 Learning before the storm: Modeling multiple stakeholder activities in support of crisis management, a practical case *Tech. Forecast.Soc. Change* vol 80, 9 pp 1742–1755
[5] A Carpignano, E Golia, C Di Mauro, S Bouchon, and J P Nordvik 2009 A methodological approach for the definition of multirisk maps at regional level: First application *J. Risk Res* vol 12, 3–4 pp 513–534
[6] Sugandi D et al 2017 *The Learning Model Used in The Teaching and Learning Process of Environmental Damage in Bandung Basin* *International Journal of Education* vol 9, 3
[7] Herdwiyanti F, Sudaryono 2013 Perbedaan Kesiapsiagaan Menghadapi Bencana Ditinjau dari Tingkat Self-Efficacy pada Anak Usia Sekolah Dasar di Daerah Dampak Bencana Gunung Kelud *Jurnal Psikologi Kepribadian dan Sosial* vol 2, 1
[8] Sulistyaningsih W 2011 *Pemulihan Anak Pasca Bencana: Pelibatan Komunitas untuk Hasil Intervensi yang Efektif* (Fakultas Psikologi Universitas Sumatera Utara)
[9] Honesti L and Djali N 2012 Analisis Ekonomi dan Finansial Pengembangan Bandar Udara Internasional Minangkabau (BIM) Di Sumatera Barat *Jurnal Momentum* vol 13, 2
[10] K Shiwaku and R Shaw 2008 Proactive co-learning: A new paradigm in disaster education *Disaster Prev. Manage* vol. 17, 2 pp 183–198
[11] M K Van Aalst 2006 The impacts of climate change on the risk of natural disasters *Disasters* vol 30, 1 pp 5–18
[12] Kolb D 1984 *Experimental Learning* New jersey: Prentice-hall, Inc
[13] Jones B F, Rasmussen C M, Moffit M C 1997 *Real-life problem solving: A collaborative approach to interdisciplinary learning* (Washington, DC: American Psychological Association)
[14] Boud D, G Feletti 1991 *The Challenge of Project-based Learning* (New York: St. Martin’s. Press. Driessen, E.W., and C.P.M. Vleuten)
[15] Singh Gurmeet 2015 *The Psychosocial Impact of Epilepsy on Young People and Their Families* (Article Community Psychologist Ministry for Children and Families)
[16] Embun B 2012 *Banjir Embun* (Retrieved from Penelitian Kepustakaan)
[17] Zed M 2014 *Metode Penelitian Kepustakaan* (Jakarta: Yayasan Obor Indonesia)
[18] Suyatno 2009 *Menjelajah Pembelajaran Inofatif* (Sidoarjo: Masmedia Buana Pusaka)
[19] Trianto 2009 *Mendesain Model Pembelajaran Inofatif-Progresif* (Surabaya: Kencana Prenada Media Group)
[20] Sanjaya W 2006 *Strategi Pembelajaran* (Jakarta: Kencana Prenada Media Group)
[21] Paul Ginnis 2008 *Trik & Taktik Mengajar – Strategi Meningkatkan Pencapaian Pengajaran di Kelas* (Jakarta: Indeks)
[22] Amir 2007 *Dasar-Dasar Penulisan Karya Ilmiah* (Surakarta: UNS Press)
[23] Johnson Elain B 2006 *Contextual Teaching and Learning* (Bandung: Mizam Learning Center)
[24] National Research Council 2007 *Nutrient Requirement of Small Ruminants : Sheep, Goats, Cervids, and New World Camelids* (Washington DC: National Academy Press)
[25] Oemarmadi Sarwedi 2005 *Lima Belas Langkah Pengadaan Barang dan Jasa Pemerintah Indonesia Procurement* (Watch-Hivos)