Development of simulation integrated learning model with mikir approach to school for disaster mitigation

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Abstract. Indonesia is a country that is prone to disasters. Therefore disaster mitigation needs to be introduced to students. This study aims to: (1) develop a model of disaster mitigation through learning in schools, (2) test the validity of disaster mitigation learning models, (3) test the effectiveness of disaster mitigation learning models in increasing understanding student skills towards the concepts, principles and practice of self-rescue in the event of a natural disaster. This research is a research and development (R&D). The research design starts with a theoretical exploration and review of disaster mitigation material to be taught, validation of the model, test the effectiveness of the model and ends with a practicality test of the model. Data analysis techniques with descriptive and quantitative. The results of the study are disaster mitigation models through learning with integrated simulation models with MIKiR approach that have been validated by experts (academics, practitioners, and policy makers), and effective to increase of understanding student skills towards the concepts, principles and practice of self-rescue in the event of a natural disaster with N-g = 0.62 in middle category

1. Introduction
Indonesia is a country that is prone to natural disasters, such as tsunamis, earthquakes, landslides, floods, hurricanes, forest fires, and volcanic eruptions. From year to year natural disasters continue to increase. Hydrometeorological disasters (floods and landslides) are the most frequent disasters. The increasing importance of disaster risk reduction is a strong foundation for Indonesia to jointly undertake disaster risk reduction efforts are integrated and focused [1]. It is necessary to increase public understanding of disaster mitigation. Learning disaster mitigation with the right, innovative and fun model is one solution to reducing disaster risk. Education in disaster resilience is very important for the government to make policies and plan for disaster response, manage post-disaster actions and evaluate disaster risk and vulnerability [2]. Teachers transfer information and knowledge to students and society. Teachers as a component of society have a strategic role in preparing young people from an early age to better understand natural disasters. The concept of natural disasters will be easy to understand if explained by using an Simulation Integrated learning model with the approach of Experiencing, Communication, Interaction, and Reflection (in Indonesia: Mengalami, Interaksi, Komunikasi dan Refleksi or MIKiR). An Simulation Integrated model is a learning model that integrates real simulations in the implementation of learning. Real simulations can provide real experiences for students to experience, so that the knowledge and skills acquired are embedded for longer. The main problems studied in disaster mitigation research are: What is the disaster mitigation model through learning with the Simulation Integrated model with the MIKiR approach? which are formulated in several research questions as follows: (a) what is the form of the Simulation Integrated model with the MIKiR approach
for disaster mitigation. (b) How is the validity of the Simulation Integrated model with the MIKiR approach being developed. (c) How effective is the Simulation Integrated model with the MIKiR approach in increasing the ability to understand and respond to disasters, before, during and after a disaster, and (d) How practical is the Simulation Integrated model with the MIKiR approach to mitigate disasters through learning in schools.

2. Methods
This research is a research development (R&D). The first stage is theoretical exploration and review of disaster mitigation materials to be taught and needs analysis. The next stage is compiling a disaster mitigation model draft through learning with an integrated simulation model using the MIKiR approach, and expert validation. The validation test of the Simulation Integrated model with the MIKiR approach by experts was carried out by 6 validators consisting of 3 lecturers and 3 teachers. Implementation of trials with experiments is the next stage, as well as to test the effectiveness of the model.

The instruments used were in the form of a model validation sheet and a questionnaire to test its practicality/acceptability. The data analysis technique used a descriptive percentage and the validation test used Aiken's V, the formula is shown in equation 1.

\[ V = \frac{\sum s}{n (c-1)} \]  

V is index validation, \( s = r \cdot lo \), \( r \) is score by expert, \( lo \) is minimal score, \( n \) is number of expert and \( c \) is maximum score.

The data analysis used test the effectiveness of disaster mitigation learning models in increasing understanding student skills towards the concepts, principles and practice of self-rescue in the event of a natural disaster is Normalized Gain (N-gain), the formula is shown in equation 2.

\[ N-g = \frac{\%postest - \%pretest}{100 - \%pretest} \]  

With category: \( N-g > 0.7 \) is high; \( 0.3 \leq N-g \leq 0.7 \) is middle, and \( N-g < 0.3 \) is low.

3. Result and Discussion
The prototype learning model for disaster mitigation and its supporting features have been developed and validated and revised based on input from the validator to become a valid learning model for use in teaching natural disasters or disaster mitigation.

3.1 Form of Simulation Integrated learning Model with MIKiR Approach
The form of the Simulation Integrated learning model with the MIKiR Approach can be seen in Figure 1. The Simulation Integrated model is composed of three main components, namely core components, supporting components, and output. The core components consist of subject matter material, disaster material, real simulation, and integrated simulation learning model syntax. Support components include support systems, reaction systems, social systems. The output components include both instructional and accompaniment impact.

3.1.1 The core components of the Simulation Integrated Model
The core components of the integrated simulation model include subject matter material, disaster material, real simulation, and syntax integrated learning simulation model. This core component serves as a reference for the implementation of the reaction system in the subject matter model, disaster material, real simulation, and syntax integrated learning model simulation.
3.1.1.1 Subject Matter
Subjects to be integrated/affixed with disaster material can be selected according to the characteristics of the material. These subjects can be Natural Science, Social Studies, Indonesian Language or others. Of course, it is necessary to map the material first, which material can be integrated with disaster material.

3.1.1.2 Material Disaster
Disaster materials that will be integrated into the subject, are selected according to the disaster to be taught, usually adjusted to disasters that often occur in their environment.

3.1.1.3 Simulation
Simulations can be carried out in two real ways and only with the help of videos. Real simulation is in the form of student activity in real simulation (role playing). Before the students carry out the simulation, a demonstration has been given by the model (teacher or outside expert) or by showing a video.

3.1.1.4 Syntax of Simulation Integrated Learning Model
The syntax of an integrated simulation learning model is made based on general steps for learning activities which include initial, core and closing activities, as well as the MIKiR approach (interaction, communication and reflection). Syntax integrated simulation model can be seen experiencing in Table 1.

3.1.2 Supporting Components of Simulation Integrated Model
The supporting components of the integrated simulation model include social systems, support systems, and reaction systems.

3.1.2.1 Social System
The social system in an integrated simulation model includes interactions between students, between students and teachers, students and the school community. Other parties that are expected to support the integrated simulation model are parents, communities, stakeholders, and other schools.
Table 1. Syntax of Simulation Integrated Model with MIKiR Approach

| Phase     | Student Activity                                      | Approach         |
|-----------|------------------------------------------------------|------------------|
| Engage    | - Pay attention to the delivery of learning objectives | Interaction      |
|           | - Responding to the perception given by the teacher   |                  |
|           | - Pay attention to giving motivation                  |                  |
| Observe   | - Pay attention to the delivery of subject matter     | Experiencing &   |
|           | - Observe simulation (video/model)                    | Interaction      |
| Doing     | - Doing real simulation in group                      | Experiencing &   |
|           |                                                       | Interaction      |
| Communicate| - Presenting the experience of doing a simulation     | Communication    |
| Closing   | - Concluding the subject matter with the teacher      | Reflection       |
|           | - Reflect                                             |                  |

3.1.2.2 Support System
The supporting system for an integrated simulation model can be obtained from the availability of facilities and infrastructure. Means include media and relevant learning resources. The infrastructure includes parks/gardens, facilitation for students with disabilities. The media that can be used in an integrated simulation model are very varied. Learning resources can take advantage of students' work as an effort to appreciate what they have done. One time, it is necessary to present real resource persons in the class.

3.1.2.3 Reaction System
The reaction system in an integrated simulation model can be seen from planning, implementation, and evaluation. Planning arrangement refers to the availability of a support system and the core activities that will be carried out. The implementation of the integrated simulation model takes into account the curriculum, the planned program (RPP is based on the syntax of the integrated simulation model), and takes into account the agreed rules. Evaluation is carried out to evaluate the success of the integrated simulation model, which can be seen from the output.

3.1.3 Output Components of the Simulation Integrated Model
The output components of an integrated simulation model include instructional and accompaniment impacts.

3.1.3.1 Instructional Impact
Instructional impacts are in the form of cognitive, affective and psychomotor learning outcomes. Cognitive learning outcomes are characterized by students' ability to understand subject matter and disasters. Affective learning outcomes can be seen the attitude/concern of students towards disasters. Psychomotor learning outcomes can be seen from the skills of students in simulating when a disaster occurs.

3.1.3.2 Accompanying Impact
A direct companion effect of the integrated simulation model is that there are examples of integrated simulation models that can be applied in other schools. The indirect impact of accompaniment is to form students who are tough, cheerful, creative, have initiative, care for the environment, and have a conservation perspective.
This model can be applied to any subject. Things that need to be considered, there must be communication between teachers and school principals. There needs to be careful planning, what subjects will be inserted into natural disasters so that there is no overlap.

3.2 The validity of the Simulation Integrated model with the MIKiR approach

The results of the assessment with the validation sheet can be seen in Table 2.

Table 2. The Results of Expert Validation of the Simulation Integrated Model with the MIKiR Approach

| Validator Code | Scoring (%) | Criteria     |
|---------------|-------------|--------------|
| D-1           | 95.25       | Very valid   |
| D-2           | 92.75       | Very valid   |
| D-3           | 93.75       | Very valid   |
| G-1           | 93.75       | Very valid   |
| G-2           | 97.50       | Very valid   |
| G-3           | 91.25       | Very valid   |
| **Average**   | **94.04**   | **Very valid** |

The results of the validation of the Simulation Integrated model with the MIKiR approach are very valid so that the model can be used with a few revisions. This result is strengthened by the calculation of Aiken's coefficient on the results of the assessment of each validator. The aspects that are assessed include aspects of the completeness of the model components, conformity to core competency, basic competency and indicator competency, suitability for disaster mitigation, logical phases in syntax, ease of model application, and applicability in society. The assessment of the model is considered valid if it has an Aiken's value of at least 0.78. This is in accordance with the criteria set by Aiken for 6 validators. Aiken's value obtained from 6 validators was 0.84. Thus it can be concluded that the Simulation Integrated learning model with the MIKiR approach has fulfilled its validity as a learning model.

3.3 The Effectiveness of Model

The results of the analysis of the effectiveness of disaster mitigation learning model to improve students' understanding of concepts, principles and practice self-rescue in case of natural disasters was obtained N-g at 0.62, middle category. This means that the Simulation Integrated model is effective in increasing understanding of the concept of disaster mitigation.

Education is a long-term defense against disaster, which enables communities to deal with disaster hazards in different ways and directly affects risk perceptions, and teaches skills and knowledge necessary for disaster mitigation [3]. Disaster risk reduction and evacuation through education for residents or the community has an impact on the perception of a higher disaster mitigation [4], and minimizes losses due to disasters [5]. Formal education such as schools and colleges is a strategic place in managing disaster mitigation [6]. Higher education has a big responsibility and can plan relevant programs to provide special skills and knowledge to the community [7].

The components of the integrated simulation learning model are in accordance with the pattern developed by regarding the learning model and learning of disaster. The active learning approach applied in disaster mitigation this time is the MIKiR [8] approach, namely experiencing, interaction, communication, and reflection.

The results of this study support previous research on natural disasters. Research on the development of a disaster learning model with an integrated SETS vision in subjects has been conducted in 2009-2011. The result of the research is a learning model for flood-prone areas. The implementation of the disaster learning model has been carried out in areas outside Java in 2013 and 2014 [9]. Community
service (in Indonesia Ipteks bagi Masyarakat) related to disaster learning has been carried out, the result is that the understanding and awareness of teachers in teaching disaster has increased [10]. The development of a disaster learning model for earthquake prone areas has been carried out in, and has been implemented in several schools in the Yogyakarta area [11], at Minangkabau [12]. Disaster simulation learning to encourage the formation of resilience [13]. Resilience is the human capacity to face, overcome and be strong on the difficulty experienced [14], and adapt to the severe events or problems that occur in the life [15].

4. Conclusion
The Simulation Integrated Learning Model with MIKiR Approach has a syntax which consists of 5 phases, namely engage, observe, doing, communinate and close. Each phase corresponds to the aspects of the MIKiR approach, which includes aspects of experience, interaction, communication and reflection. This model has been validated by 6 validators. The average score of the validation results was 94.04 and the validation index with Aiken’s V was 0.84 in the valid category.

The Simulation Integrated Model with MIKiR Approach is effective in increasing understanding of the concept of disaster mitigation student’s. The amount of increased understanding of the concept of disaster mitigation was 0.62 in the middle category.

The results of this research can be used as a reference for policy makers in the field of education to develop education about natural disasters. With the learning of natural disasters in schools, community preparedness in facing natural disasters will be better, so that disaster anticipation and management can be carried out appropriately.

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