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# Development of Subject-Specific Pedagogy for Natural Science Based on the MIKiR Approach for Landslide Disaster Prevention

**Erwin Prastyo[1], Dewi Lengkana[2], Heri Setiadi[3]**
[1] MTs Darul Ishlah Sukorejo, Kendal, Indonesia
[2] Biology Education, University of Lampung, Bandar Lampung, Indonesia
[3] SEAMEO Regional Centre for QITEP in Science, Bandung, Indonesia
E-mail: [1]prasetyo.wiwin@gmail.com*, [2]dewi.lengkana@fkip.unila.ac.id , [3]setiadiheri@gmail.com
*Coresponding Author

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**ABSTRACT**
Students' lack of disaster response mindset is both a problem and a challenge that must be addressed in science education. Based on the MIKiR approach, which is linked with natural disaster prevention, the goal of this study is to define the features of science Subject-Specific Pedagogy. This study involves both research and development (R&D). The research procedure follows the Borg & Gall development model, which involves five main steps: (1) analyzing the product to be developed; (2) developing the initial product; (3) expert validation and revision; (4) small-scale field testing and revisions; and (5) large-scale field testing and final products. A validation sheet with a Likert scale in the form of a checklist serves as the research instrument. According to the study's findings, the quality of the developed Subject-Specific Pedagogy listed in good category, with an optimum proportion of 84.33 percent. The findings of the study on product quality could be used as one of the science learning aids in SMP/MTs class IX semester 2.

***Keywords:*** *Landslide Disaster Prevention, Subject-Specific Pedagogy, the MIKiR Approach*



## INTRODUCTION

Kendal Regency is one of the Central Java regions with a high landslide risk rating (Pusat Vulkanologi Mitigasi Bencana Geologi, 2019). According to data from the Kendal Regency's Regional Disaster Management Agency (BPBD), landslides occurred at 48 different locations in 2021. The districts of Singorojo and Sukorejo have the highest landslide intensity (BPBD Kabupaten Kendal, 2021). The landslide's impact resulted in deaths, property damage, and material losses (Yogiswara et al., 2020).

The main factor of the enormous number of victims, property damage, and losses caused by disasters as a result of the community's lack of understanding and awareness of catastrophe hazards in their location. The preparedness of students in landslide-prone areas in Kendal Regency in dealing with landslides is still relatively low, at 44,17 percent, which includes aspects such as knowledge (52,04 percent), planning (51,83 percent), early warning systems (25,57 percent), resource mobilization (24,29 percent), and awareness (67,13 percent) (Prastyo et al., 2021).

This inadequate degree of readiness is due to the lack of natural disaster mitigation education or the integration of disaster materials into school curricula. Other factors contributing to Indonesia's inadequate disaster mitigation learning practice include: natural disaster education curriculum not being integrated with learning curriculum (Hamisesa et al., 2018); reference books not providing a portion of natural disaster education (Nurdiyanto et al., 2019); limited subject matter that can be easily accessed by teachers (Wedyawati et al., 2017); and low disaster education communication in realizing a safe environment (Harnita, 2021).

Formal education in schools is one method of educating the public about disasters (Atmojo et al., 2018). Education can help to promote and build disaster preparedness (Hoffmann & Muttarak, 2017); disaster knowledge and perception (Kawasaki et al., 2020)**;** disaster response planning; and post-disaster management (Perdikou et al., 2014) in order to create a community that is resilient to catastrophes (Atmojo et al., 2018).

Integration of landslide catastrophe learning into school curricula is a critical priority at this time. Science is one of the areas that has a lot of potential as a learning tool for preventing natural disasters (Agustiana et al., 2013; Rusilowati et al., 2012). Learning about disaster mitigation should be done using a simulation model that incorporates the cognitive, afective, and psychomotor domains (Mantasia & Jaya, 2016; Rusilowati et al., 2012).

The construction of learning device components, such as syllabus, lesson plan, student worksheet, teaching material, and assessment instrument, is required to enable disaster mitigation learning that is incorporated with science learning. Furthermore, Subject Specific Pedagogy (SSP) refers to the organization of all learning components. SSP is packaged into instructive, complete, and solid learning aids, including components such as competences, sub-competencies, resources, strategies, methods, media, and evaluation (Hartati et al., 2009). SSP plays a critical function in assisting and facilitating integrated science learning so that students gain a holistic understanding of science (Sya'ban & Wilujeng, 2016; Tyas et al., 2020).

In normal learning scenarios or face-to-face learning, previous research has demonstrated positive effects in assisting students in elements of disaster preparedness, concept mastering, creative thinking, and crisis management. There is yet no SSP product to support integrated science learning for landslide disaster mitigation for distance learning, which demands the learning process to be carried out utilizing the distance learning or online learning. Furthermore, at the SMP/MTs level, disaster learning resources are still oriented on seventh grade.

The approach of *Mengalami*, *Interaksi*, *Komunikasi*, and *Refleksi* (MIKiR) is used to develop the SSP. Affan Surya established the MIKiR approach through the Tanoto Foundation program to approach existing ways such that teachers have difficulty learning (Muhammad & Rusilowati, 2020). The MIKiR approach combine an active learning strategy that aids in the development of students' 21st-century skills.

Previous research has found that using the MIKiR approach in the classroom can help students improve scientific literacy and creativity (Muhammad & Rusilowati, 2020); critical thinking skills (Alpusari et al., 2020); visual literacy skills (Azim & Sulhani, 2020); scientific communication skills (Alpusari et al., 2019); creativity, teamwork, and critical thinking (Fatmawati et al., 2021; Diniya et al., 2021).

This research aims to determine the quality and feasibility of the developed SSP based on the above description. It is hoped that the MIKiR approach-based SSP developed can facilitate integrated science learning for landslide disaster mitigation at the SMP/MTs level by combining and packaging appropriate components and supporting them with appropriate learning model.

## METHODS

*Research Design*

This study comprises research and development (R&D), with the goal of developing learning device products in the form of Subject Specific Pedagogy (SSP) in science learning. A syllabus, lesson plan, student worksheet, teaching material (handout), and student evaluation sheet comprise the SSP component produced.

*Research Procedure*

The development steps consist of: (1) assessing the product to be created; (2) producing the first product; (3) expert validation and revision; (4) small-scale field testing and product changes; and (5) large-scale field testing and final products (Puslitjaknov, 2008). This research was conducted at MTs Darul Ishlah Sukorejo in the Kendal Regency of Central Java. Two experts, lecturers and senior science teachers, were the study's subjects. This study's data includes both quantitative and qualitative information. Quantitative data comes in the form of a SSP score expert evaluation. Expert feedback, corrections, suggestions, and criticisms. The research instrument, in the form of an SSP validation sheet, was used to obtain a quality overview as well as data on suggestions, comments, and expert evaluations.

*Data Analysis*

Comments, suggestions, and revisions were analyzed descriptively and qualitatively, and the results were used to revise the developed SSP product. The following data analysis techniques were used in the form of expert responses (quality of SSP products): (1) tabulated all expert data for each component of the assessment items in the assessment instrument; (2) calculated the average total score for each component; (3) converted the score to a standard score of 0-100; and (4) converted the average score into a value with criteria. Table 1 shows the reference for adjusting the score products (Sya`ban & Wilujeng, 2016).

*Table 1. Score Conversion Reference into Value with Criteria*

| Scores Range | Value | Category |
|---|---|---|
| $X > M + 1{,}5\ S$ | A | Excellent |
| $M + 0{,}5\ S < X \leq M + 1{,}5\ S$ | B | Good |
| $M - 0{,}5\ S < X \leq M + 1{,}5\ S$ | C | Enough |
| $M - 0{,}5\ S < X \leq M - 1{,}5S$ | D | Fair |
| $X \leq M - 1{,}5\ S$ | E | Poor |

Description:

$X$ = actual score

$M$ = ideal score average

$S$ = ideal standard deviation

The SSP with expert judgment quality, namely excellent or good, is feasible to be used in science learning.

## RESULTS AND DISCUSSION

Two experts, one lecturer and one senior science teacher, collaborate on the product validation and assessment of Subject Specific Pedagogy (SSP) in science. The goal of product validation is to gather constructive feedback, comments, and suggestions in order to improve the developed SSP.

On the topic "Land and Sustainability of Life," which is integrated with landslide disaster preparedness, this SSP was developed based on the *Mengalami, Interaksi, Komunikasi, Refleksi*, or MIKiR approach. Figure 1 shows the display cover of developed teaching material in the form of handout.


*Figure 1. Handout's Cover*

Table 2 shows the results of the assessment of the five components of the SSP (syllabus, lesson plan, student worksheet, handout, and assessment sheet).

*Table 2. The Results of SSP Quality Assessment*

| Component of SSP | Expert (N=2) | |
|---|---|---|
| | Percentage of Ideal Score (%) | Category |
| Syllabus | 82,50 | Good |
| Lesson Plan | 85 | Excellent |
| Student Worksheet | 89,16 | Excellent |
| Handout | 84,16 | Excellent |
| Assessment Sheet | 80 | Good |

According to the findings, the overall average SSP score is 253, with an ideal percentage of 84,33 percent. The SSP that has been developed falls into the category of good quality based on the ideal calculation.

The ideal syllabus component percentage is 82,50 percent. The average score for the syllabus component is 33. As a result, the syllabus is considered to be of high quality. Criteria for syllabus format, Basic Competence (KD), indicators, mitigation aspects, learning experiences, disaster preparedness aspects, time allocation, assessment, and learning resources are among the criteria assessed by the expert on the syllabus components.

The obtained average score on the lesson plan assessment is 68. As a result, the lesson plan is rated as excellent, with an ideal score of 85 percent. Aspects of the formulation of learning objectives, aspects of material selection, aspects of learning resource selection, aspects of scenarios/learning activities, and aspects of learning outcome assessment are all assessed in the lesson plan.

The average score for the student worksheet component is 53,50, with an ideal percentage of 89.16 percent. As a result, the student worksheet is rated as excellent. Aspects of didactic requirements and aspects of construction requirements are assessed in the student worksheet.

The average score for the teaching materials component is 50,5, with an ideal percentage of 84,16 percent. As a result, the teaching materials are rated as excellent. The feasibility of the content and the feasibility of the language are two aspects of the teaching materials that are evaluated.

The average score for the assessment sheet component, which consists of an attitude scale and an observation sheet, is 48. As a result, the evaluation sheet is rated as excellent, with an ideal percentage of 85 percent. Material aspects, construction aspects, and linguistic aspects are among the aspects assessed on the assessment sheet. Figure 2 shows a comparison of the percentage ideals for each component of the SSP.

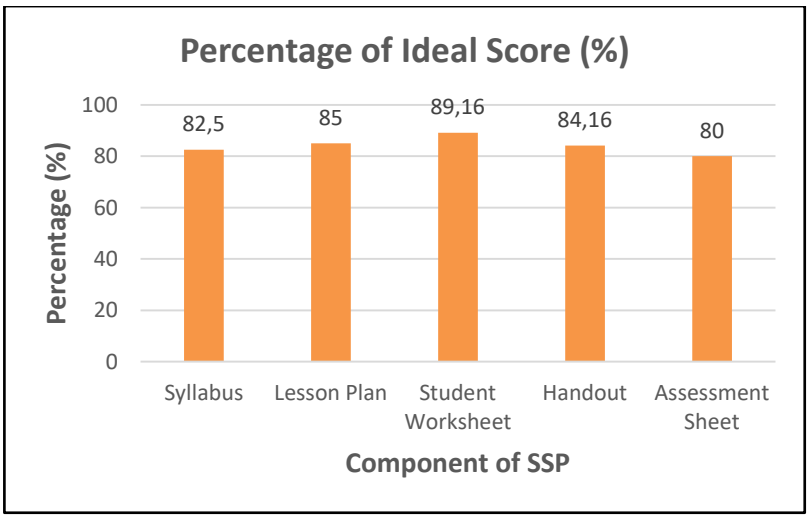


*Figure 2. Percentage Comparison of SSP Components*

According to the expert, it was declared to have good quality based on the stages that were passed in the SSP development research. The superiority of the SSP that have been successfully developed are (1) integrating science material with landslide disaster preparedness according to conditions in landslide-prone areas, according to the upper region conditions in Kendal Regency, which has not been developed in previous studies; (2) the basis for developing the SSP in science using the MIKiR approach, which supports the development of students' process skills in science learning; (3) the developed SSP can be applied in distance learning situations and normal learning situations (conditional). Teaching materials (handout), student worksheet, and evaluation sheet can all be converted to electronic format in a distance learning situation. And meanwhile, the SSP's components can be printed and used in the normal learning situations.

## CONCLUSION

The quality of the SSP product is good overall with an ideal percentage of 84,33 percent and is suitable for use in science learning. Details of each component, namely syllabus, lesson plan, student worksheet, handout, and successive assessment sheets with ideal percentage is 82,50 percent; 85 percent; 89,16 percent; 84,16 percent; and 80 percent. Based on these

results, the SSP product is feasible for use in science learning expecially for grade IX SMP/MTs Semester 2.

**CONFLICT OF INTEREST**

We do not have any conflicts of interest to declare.

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