

Development of Integrated Physics Teaching Materials for Landslide Disaster Mitigation and Islamic Science on Newton's Law for Gravity

Muhammad Gibran Alif Prasetya¹, M. Aryono Adhi², Budi Naini Mindyarto³, Langlang Handayani⁴

^{1,2,3,4}Department of Physics Education, Universitas Negeri Semarang, Semarang, Indonesia

Abstract

This research is motivated by the high potential for natural disasters, one of which is landslides that occur in areas with mountainous topography. This condition requires the strengthening of disaster mitigation education from an early age through formal education channels, especially in schools in disaster-prone areas. However, physics learning in Islamic schools generally still focuses on theoretical concepts, has not been integrated with the context of disasters and Islamic values, and is supported by less contextual teaching materials. This research aims to develop integrated physics teaching materials for landslide disaster mitigation and Islamic science on Newton's Law of Gravity material, as well as to examine the level of validity and response of students to the developed teaching materials. The research method used is research and development with the Borg and Gall procedure. The teaching material products were validated by material experts and media experts, and tested for readability and user response in MA Muwahidun students. The results of the study showed that the teaching materials developed had a very high level of feasibility with a validity percentage of 80.41%. The readability test showed a percentage of 90% with the easy-to-understand category, while the students' response obtained an average score of 86.44% with a very positive category. These findings show that integrated physics teaching materials for disaster mitigation and Islamic science are effective in supporting contextual learning, improving disaster preparedness, and instilling Islamic values. Thus, this teaching material is suitable for use as an alternative to learning physics in Islamic schools in disaster-prone areas.

Keywords: Teaching Materials, Integration of Landslide Disaster Mitigation and Islamic Science, Newton's Law of Gravity

Corresponding Author:

Muhammad Gibran Alif Prasetya

Department of Physics Education, Universitas Negeri Semarang, Indonesia

Jl. Raya Semarang-Gunungpati, Sekaran, Gunungpati, Kota Semarang

Jawa Tengah 50229

Email: gibranrmn@gmail.com

1. INTRODUCTION

Indonesia is a country that has a high level of vulnerability to geological disasters, one of which is landslides that occur in hilly and mountainous areas. Indonesia's geographical conditions, which are dominated by undulating reliefs, high rainfall, and rapid changes in land use, cause the risk of landslides to increase from year to year. Landslides not only cause material losses, but also threaten life safety and the sustainability of social activities and community education (Utia & Fauzi, 2021). Therefore, disaster mitigation efforts are an urgent need that must be carried out systematically and sustainably.

One of the areas that has a high potential for landslides is Gembong District, Pati Regency, which is located at the foot of Mount Muria. This region has a topography in the form of slopes with relatively steep slopes and significant elevation variations, making it susceptible to the movement of soil masses, especially in the rainy season. Several landslides that occurred in this region show that disaster risks are real and repeated. This condition requires a mitigation strategy that is not only technical and structural, but also preventive through increasing knowledge and preparedness of the community, including students in schools (Ayub et al., 2021).

Education has a strategic role in building awareness and disaster preparedness from an early age. Through the learning process, students can be equipped with the knowledge, attitudes, and skills needed to understand the potential for disasters in their environment and how to reduce the risks posed. One of the subjects that has strong relevance to disaster phenomena is physics (Jannah et al., 2022). Physical concepts, especially in Newton's Law and gravitational matter, are directly related to the principles of force, mass, acceleration, and motion of objects, which can be used to explain the mechanism of landslides in a scientific way (Dzakiya, 2021). Thus, physics learning has the potential to be an effective medium to integrate disaster mitigation education contextually.

However, the practice of learning physics in schools still faces various challenges. Learning is often oriented towards mastering concepts and solving mathematical problems (Saputra et al., 2023), without associating them with real phenomena that are close to the lives of students (Penggabean & Danis, 2020). As a result, physics is perceived as an abstract, elusive, and less meaningful subject. This condition is reinforced by the limitations of teaching materials used in schools, which are generally general and have not adapted to the context of the local environment, including the conditions of disaster-prone areas.

In Islamic schools, such as Madrasah Aliyah, the challenges of learning physics become more complex. In addition to the demands of mastery of science concepts, learning in Islamic schools is also expected to be able to inculcate Islamic values in every subject (Zainuddin et al., 2020). The integration of Islamic science values in physics learning is important to form students who not only have academic competence, but also spiritual awareness, environmental ethics, and responsibility as caliphs on earth (Susilowati, 2017). However, in practice, physics learning at Madrasah Aliyah still tends to separate science and Islamic values, so the potential for integration of the two has not been utilized optimally.

The results of the preliminary study at MA Muwahidun, Gembong District show that students have a relatively low interest in physics subjects and have difficulties in understanding the material of Newton's Law for Gravity. Students assessed that the textbooks used were less contextual, both in terms of the presentation of the material and their relationship with the surrounding environmental conditions. In addition, the majority of students stated the importance of integrating Islamic values and disaster education in physics learning, especially considering that schools are in landslide-prone areas. This finding was strengthened by the results of interviews with physics teachers who stated that the available teaching materials have not integrated disaster mitigation and Islamic science in a written and systematic manner, so teachers must convey these values orally and in a limited way.

Several previous studies have developed contextual based physics teaching materials (Febrianti et al., 2022; Midroro et al., 2021; Wardani et al., 2021), teaching materials with religious values (Saftina et al., 2021; Vitrianingsih et al., 2021), as well as teaching materials that integrate disaster education (Jannah et al., 2022; Rahmat et al., 2020). However, the development of teaching materials that integrate the concepts of physics, landslide disaster mitigation, and Islamic science is still very limited. In particular, there have not been many studies that have examined the development of physics teaching materials on Newton's Law of Gravity material intended for Islamic schools in disaster prone areas and tested the feasibility of the product and the students' response to the teaching materials. This gap is the basis for the need for further research.

Based on this description, this study aims to develop integrated physics teaching materials for landslide disaster mitigation and Islamic science on Newton's Law of Gravity material. In addition, this study aims to determine the level of validity of the teaching materials developed and the students' response to their use in physics learning at MA Muwahidun. The results of this study are expected to contribute to the development of physics learning that is contextual, religious, and relevant to the characteristics of students in Islamic schools in disaster prone areas.

2. METHODS

This research uses a Research and Development (R&D) approach that aims to develop and test the feasibility of teaching materials for integrated physics of landslide disaster mitigation and Islamic science on Newton's Law of Gravity material. The R&D approach was chosen because the research not only focuses on testing theory, but also produces learning products that can be used directly. The

developmental model used refers to Borg and Gall (1979) in Sa'adah & Wahyu (2020), covering the stages of analysis presented in the following Figure 1.

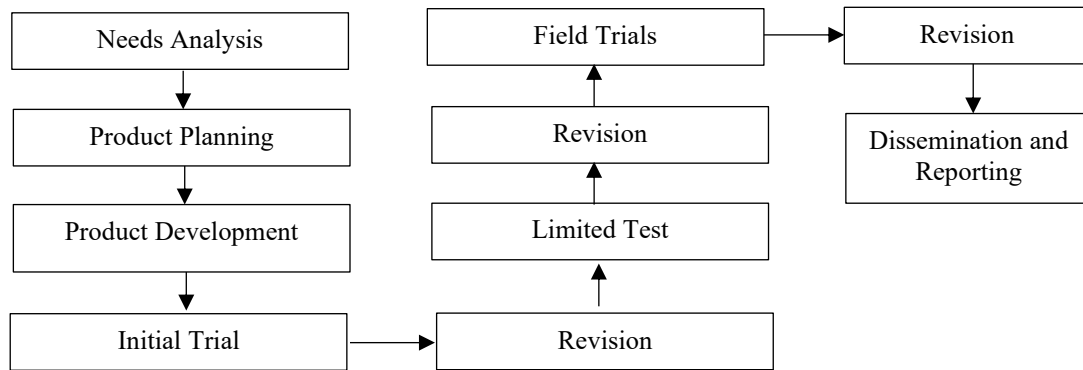


Figure 1. Borg & Gall Model Teaching Material Development Procedure

The research was carried out in MA Muwahidun, Gembong District, Pati Regency, Central Java, which is an area prone to landslides. The research subject involved students in class XI MIPA who had studied Newton's Law for Gravity material in class X. Small-scale trials involved 8 students, while large-scale trials involved all students of class XI MIPA which were divided into two classes, namely the Ikhwan class (XI Science 1) and the Akhwat class (XI Science 2). In addition to students, this research also involves expert validators consisting of physics material experts, learning media experts, disaster mitigation experts, Islamic science integration experts, and a physics teacher as learning practitioners.

The teaching material development procedure begins with a preliminary study through learning observation, interviews with physics teachers, and the distribution of questionnaires to students to analyze the needs of teaching materials. The next stage is product design by analyzing core competencies, basic competencies, indicators, and learning objectives, then compiling physics materials that are integrated with landslide disaster mitigation and Islamic science. The teaching material products that have been developed are then validated by experts to assess the feasibility of content, presentation, language, integration of Islamic values, and disaster aspects. The product is revised based on validator input, then tested on students through limited trials and field trials, before final revisions.

The research instruments used included observation sheets, interview guidelines, questionnaires, group tests, and documentation. Observations and interviews were used to obtain preliminary data related to learning conditions and teaching material needs. A needs analysis questionnaire was given to students in the early stages of the research using the Guttman scale. The expert validation questionnaire and the student response questionnaire used the Likert scale to obtain data on the feasibility and practicality of teaching materials. The rumpang test is used to measure the readability level of teaching materials, while documentation is used to collect supporting data in the form of syllabus, lesson plans, and documentation of research implementation.

The data obtained were analyzed descriptively quantitatively. The data from the expert validation results was analyzed by calculating the percentage of the eligibility score and classified into the eligibility category. Readability data was analyzed based on the percentage of students' understanding of the content of the teaching material and categorized according to the level of readability. Students' responses were analyzed by calculating the percentage of questionnaire scores and classified into categories of very positive, positive, less positive, or not positive. The results of the analysis are used as a basis for revising the product and determining the final feasibility of teaching materials. This research has obtained permission from the school, and all participants are voluntarily involved by maintaining the confidentiality of the data obtained.

3. RESULT AND DISCUSSION

Result

This research produced products in the form of teaching materials for integrated physics of landslide disaster mitigation and Islamic science on Newton's Law for Gravity which was developed through the following stages:

Needs Analysis Results

The results of this analysis show that most students assess physics subjects as difficult to understand, especially in the material of Newton's Law of Gravity. Students stated that the textbooks used were not contextual and had not related physics material to the surrounding environmental conditions and Islamic values. In addition, the majority of students stated the need for physics teaching materials that contain landslide disaster education and the integration of Islamic science, considering that schools are in landslide-prone areas. These results can be shown in Figure 2.

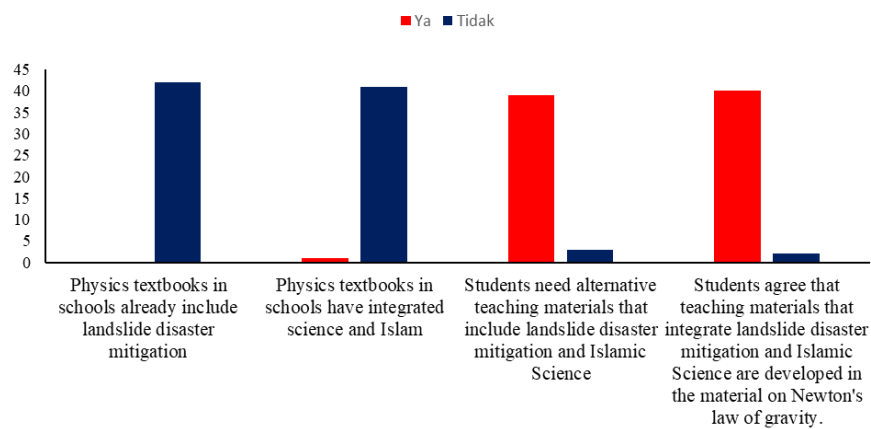


Figure 2. Diagram of Analysis of Physics Teaching Material Needs for Students

The results of the questionnaire show three main findings. First, most students consider physics to be a difficult subject to understand, especially in the material Newton's Law of Gravity, which is caused by the limitations of handbooks in terms of material completeness, presentation techniques, and format. Second, in learning physics in Islamic schools in landslide-prone areas, teachers have not integrated Islamic values, even though the majority of students consider the integration of Islamic values and disaster education as important. Third, the needs analysis showed that the physics textbooks used did not contain landslide disaster mitigation education and Islamic studies, so that students expressed the need and approval for the development of physics teaching materials that integrate these two aspects into the material of Newton's Law for Gravity.

Product Development Results

After going through the results of product design/planning, the results of the stages of making integrated physics teaching materials for landslide disaster mitigation and Islamic science are arranged into three main parts, namely the introduction, the content part, and the closing part. The introduction section consists of a front cover, a thank you and book identity, a foreword, instructions for use and a table of contents. The content of the teaching material consists of sections, namely chapter titles, Perception, keywords, concept maps, IP, KD, and learning objectives, Islamic studies, material descriptions, brief info, question analysis, practice questions, disaster insights, Islamic encyclopedia, let's experiment, and Traces of Muslim scientists. Meanwhile, the closing part consists of a summary, evaluation sheet, feedback, guts test questions, answer keys, bibliography and back cover. The display of integrated physics teaching materials for landslide disaster mitigation and Islamic science on Newton's law for gravity material is presented in Figure 3. to figure 5.

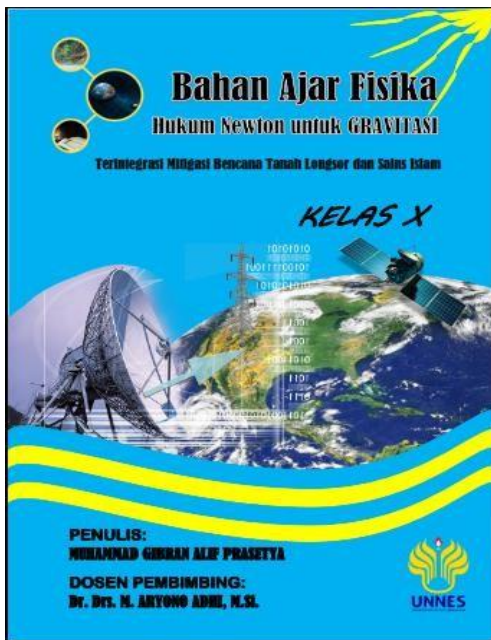


Figure 3. Front Cover Page

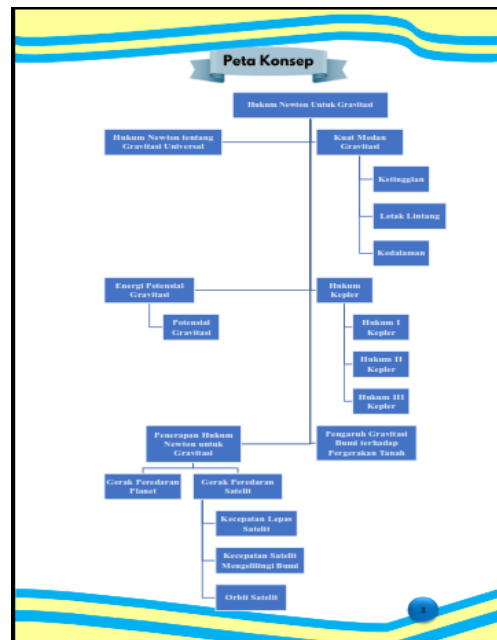


Figure 4. Concept Map Page

C. Energi Potensial Gravitasi

Energi potensial dapat didefinisikan sebagai energi yang dimiliki benda karena keadaan atau kedudukannya (posisinya). Selain itu, energi potensial juga dapat didefinisikan sebagai energi yang tersimpan dalam suatu benda. Energi potensial gravitasi merupakan energi yang dimiliki oleh benda berhubungan dengan kedudukannya melakukan usaha. Persamaan energi potensial gravitasi dapat dirumuskan sebagai berikut.

$$E_p = W = -G \frac{Mm}{r} \quad (9)$$

Keterangan:
 E_p = energi potensial gravitasi (J)
 W = usaha untuk memindahkan massa (J)
 G = tetapan gravitasi (Nm^2/kg^2)
 M = massa benda pertama (kg)
 m = massa benda kedua (kg)
 r = jarak benda (m)

Persamaan di atas secara umum digunakan untuk menentukan energi potensial dua benda bermassa M dan m yang berjarak r satu sama lain. Tanda negatif pada persamaan tersebut menunjukkan bahwa gaya gravitasi yang bekerja pada benda adalah gaya tarik. Tanda negatif menyatakan bahwa untuk membawa benda bermassa m ke tempat jauh tak terhingga dibutuhkan usaha atau energi sebesar $G \frac{Mm}{r}$.

Figure 4. Material Description Page

Rangkuman

- Oaya gravitasi adalah gaya interaksi yang berupa tarik-menarik antara benda.
- Hukum Gravitasi Newton berbunyi "Setiap benda di alam semesta menarik benda lain dengan gaya yang besarnya berbanding lurus dengan hasil kali massa-massanya dan berbanding terbalik dengan kuadrat jarak antara keduanya", dirumuskan: $F = G \frac{Mm}{r^2}$.
 Cavendish mendapatkan nilai G sebesar $6,67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$.
- Perccepatan gravitasi adalah percepatan suatu benda akibat gaya gravitasi, yang besarnya: $g = G \frac{M}{r^2}$.
- Apabila benda berada pada ketinggian h dari permukaan bumi atau $R = h$ dari pusat bumi, maka besarnya percepatan gravitasi benda tersebut adalah: $g = \left(\frac{R}{r}\right)^2 g_0$.
- Energi potensial gravitasi dinyatakan dengan persamaan: $E_p = W = -G \frac{Mm}{r}$.
- Kepler mengemukakan tiga hukum yang berhubungan dengan peredaran planet terhadap Matahari, yaitu:
 - Hukum I Kepler: "Setiap planet bergerak mengitari Matahari dengan lintasan berbentuk elips, Matahari berada pada salah satu titik fokusnya".
 - Hukum II Kepler: "Suatu garis khayal yang menghubungkan Matahari dengan planeti menyapu daerah yang luasnya sama dalam waktu yang sama".
 - Hukum III Kepler: "Perbandingan kuadrat periode planet mengitari Matahari dengan pangkat tiga jarak rata-rata planet ke Matahari adalah sama untuk semua planet", dirumuskan: $\frac{T^2}{a^3} = \frac{4\pi^2}{GM}$.
- Orbit geosinkron adalah orbit satelit dimana periodenya sama dengan periode rotasi bumi. Besarnya laju sudut adalah: $\omega = \sqrt{\frac{GM}{r^3}}$ dengan jarak orbit satelit adalah: $r = \sqrt[3]{\frac{GMT^2}{4\pi^2}}$.
- Dampak negatif adanya gravitasi bumi ialah menyebabkan terjadinya tanah longsor. Tanah longsor (*land slide*) merupakan proses berpindahnya massa tanah/batuan dengan volume yang cukup besar sebagai akibat adanya gaya gravitasi pada suatu miring di daerah lereng.

Figure 5. Summary Page

Expert Validation Results

Products that have been completed are assessed by experts. The teaching materials developed are validated by expert validators for feasibility testing of the developed products. Validation was carried out by 3 validators of physics material experts, 1 validator of Islamic science material experts, 1 validator of disaster experts, 1 validator of media experts, and 1 practitioner/teacher of physics as experts in physics material. The percentage of expert assessment results on integrated physics teaching materials, landslide disaster mitigation, and Islamic science in each aspect can be presented in Table 1. in below.

Table 1. Results of Validation of Teaching Materials by Experts in Each Aspect of Assessment

Aspects	Eligibility Percentage	Categories
Feasibility of Physics Material Content	80%	Worthy
Qualifications for Islamic Science	83%	Worthy

Aspects	Eligibility Percentage	Categories
Content		
Disaster Content Eligibility	80%	Worthy
Content Eligibility	77%	Worthy
Language Qualifications	81,67%	Worthy
Presentation Eligibility	85,56%	Worthy
Graphic Qualification	75,83%	Worthy

Table 1. shows that the results of the validation of integrated physics teaching materials for landslide disaster mitigation and Islamic science were obtained from the assessment of experts who include material aspects, integration of Islamic science, disaster mitigation, language, presentation, and graphics in the feasible category. Thus, the developed integrated physics teaching materials for landslide mitigation are suitable for use in learning based on the assessment of experts in their fields.

Nevertheless, the validators also provided several comments and suggestions for improvements to enhance the quality of the teaching materials. This input served as the basis for product revisions, particularly in terms of content, language, presentation, and graphics, resulting in more optimal teaching materials. The results of the improvements or revisions to the teaching materials based on the expert input are presented in Figure 6.



Figure 6. Before Revision



Figure 7. After Revision

Figure 6 shows the results of the revisions to the teaching materials based on comments and suggestions from the validators. The validators highlighted that the blue background of the instructional materials' user manuals made the text less legible. Furthermore, several illustrations and screenshots in the teaching materials were deemed to have less than optimal color contrast, too small a font size, and an unreadable font. Following this feedback, improvements were made, as shown in Figure 7. The background of the instructional materials was changed from blue to yellow to make the text clearer and easier to read. The colors in the images were also made more contrasting by adjusting the brightness level, while the font type was replaced from Times New Roman to Arial Narrow to improve visual clarity. In addition, the screenshot display size is enlarged so that the text in it can be read more clearly.

Results of small scale trials

The feasibility of this teaching material is certainly inseparable from the guidance, input and suggestions of experts. After the teaching materials have been validated and revised according to the

validator's input and suggestions, the module is ready to conduct a second product test, namely the readability test. Data from the readability test of integrated physics teaching materials for landslide disaster mitigation and Islamic science are presented in Table 2. in below.

Table 2. Results of Readability Test of Integrated Physics Teaching Materials for Landslide Disaster Mitigation and Islamic Science

No.	Participant Code Educate	Score	Percentage Score (%)	Categories
1.	Ikhwan -1	49	98%	Easy-to-understand discourse
2.	Ikhwan -2	48	96%	Easy-to-understand discourse
3.	Ikhwan -3	44	88%	Easy-to-understand discourse
4.	Ikhwan -4	42	84%	Easy-to-understand discourse
5.	Akhwat -1	46	92%	Easy-to-understand discourse
6.	Akhwat-2	43	86%	Easy-to-understand discourse
7.	Akhwat-3	45	90%	Easy-to-understand discourse
8.	Akhwat-4	43	86%	Easy-to-understand discourse
	Average	45	90%	Easy-to-understand discourse

Based on Table 2, data was obtained from the readability test of integrated physics teaching materials for landslide disaster mitigation and Islamic science conducted on 8 samples of students in the category of easy-to-understand discourse with an average score percentage of 90%. This shows that the teaching materials for integrated physics of landslide mitigation and Islamic science from the aspect of readability are in the very good category and the teaching materials developed are easy to understand by students.

Large Scale Test Results

The next stage is large-scale testing. In this large-scale test, the researcher conducted a study by looking at the response of students to teaching materials on integrated physics, landslide disaster mitigation, and Islamic science. The student response test was carried out on 41 respondents of class XI students who had previously studied Newton's Law for Gravity material, with a proportion of 17 students in the Ikhwan class (XI Science 1) and 24 students in the Akhwat class (XI Science 2). The results of the student response test in the large-scale test showed that the teaching materials received a very positive response. Based on the results of the questionnaire, the average percentage of student responses was 86.62%, with a very positive category. Positive responses were shown in both the ikhwan and akhwat classes. These findings show that teaching materials are well received by students as a learning resource to support physics learning.

Judging from the aspect of appearance, the teaching materials obtained an average score of 87.73% with a very positive category, supported by attractive designs and clarity and suitability of illustrations. The linguistic aspect obtained a score of 84.98% with a positive category, showing that the language, typeface, and presentation of the text are easy for students to understand. In terms of content, the teaching materials received a very positive response with an average score of 88.08%, which shows the suitability of the material with the subject of Newton's Law for Gravity as well as the successful integration of physics concepts, landslide disaster mitigation, and Islamic science. The use aspect obtained a score of 83.46% with a positive category, indicating that the instructions for using the teaching materials are clear and easy to follow. Meanwhile, the functional aspect obtained a score of 86.29% with a very positive category, which shows that the teaching materials are able to improve students' understanding, support independent learning, and provide benefits through supporting content such as disaster insights, Islamic studies, and contextual problem exercises.

Discussion

The results of the study showed that the integrated physics teaching materials for landslide disaster mitigation and Islamic science developed had met the eligibility criteria and were positively accepted by students. This finding is in line with the purpose of the research, which is to produce physics

teaching materials that not only support the understanding of the concept of Newton's Law for Gravity, but also instill Islamic values and increase disaster literacy in students in Islamic schools in landslide-prone areas.

The level of feasibility of teaching materials in the category of feasible to very feasible shows that the integration between the concepts of physics, disaster mitigation, and Islamic science can be carried out in harmony without causing conceptual misconceptions. Validation by experts ensures that the physical material remains scientifically accurate, while the integration of Qur'anic verses and disaster content is presented in a relevant and contextual manner. These findings support the view that the integration of science and religious values can enrich the meaning of learning without diminishing the depth of the material (Anggereni et al., 2019; Anggraini et al., 2021; Saftina et al., 2021; Vitrianingsih et al., 2021).

The results of the high readability test showed that the teaching materials were arranged with language, structure, and presentation that were in accordance with the level of development of the students. This indicates that the revision process based on expert input contributes significantly to improving the quality of teaching materials. These findings are in line with the theory of teaching material development that emphasizes the importance of readability as a prerequisite for learning effectiveness (Dewi & Arini, 2018; Riefani & Mahrudin, 2020).

The very positive response from students shows that teaching materials not only function as a learning resource, but are also able to increase interest and motivation to learn physics. The integration of disaster mitigation provides a real context that is close to the lives of learners, while the integration of Islamic science strengthens the understanding that physical phenomena are in harmony with the values of faith. This supports the findings of previous research that states that physics learning based on local context and religious values can increase students' engagement and learning meaning (Diani et al., 2019; Rahmat et al., 2020; Santoso & Wuryandani, 2020).

The findings of the students' interviews reinforced the quantitative results by showing that the teaching materials were seen as interesting, easy to understand, and relevant to their needs. Students stated that the content of disaster insights, Islamic studies, and visual illustrations helped them understand the concept more completely. The triangulation of questionnaire and interview data strengthens the validity of the findings and shows that the teaching materials have the potential to be implemented in physics learning in Islamic schools in disaster-prone areas.

Theoretically, this research contributes to the development of a multidisciplinary integration physics teaching material model that connects science, disasters, and religious values. Practically, the teaching materials developed can be an alternative contextual learning resource for physics teachers in Islamic schools, especially in disaster-prone areas. From a methodological perspective, this study shows that the Borg and Gall Research and Development model is effectively used to develop integrated teaching materials that are contextual and based on field needs.

However, this study has some limitations. Testing of teaching materials is still limited to tests of eligibility, readability, and student response, so it has not measured its impact on improving learning outcomes or disaster preparedness quantitatively. In addition, the research was conducted on one school with certain characteristics, so the generalization of the findings is still limited. Further research is suggested to test the effectiveness of teaching materials through experimental design and apply them to more diverse school contexts.

4. CONCLUSION

This research has succeeded in developing teaching materials for integrated physics of landslide disaster mitigation and Islamic science on Newton's Law for Gravity material that is in accordance with the learning needs of Islamic schools in landslide-prone areas. The results of expert validation show that teaching materials are in the category of feasible to very feasible from the aspects of physics material, integration of Islamic science, disaster mitigation, and learning media. In addition, the readability test showed that the teaching materials were easy for students to understand, and the results of the response questionnaire and interviews indicated a very positive acceptance of the content, appearance, and function of the teaching materials.




These findings confirm that the integration of physics concepts with the context of disasters and Islamic values can be realized in harmony without reducing the scientific accuracy of the material. Thus, the teaching materials developed have the potential to be an alternative learning resource that is contextual, meaningful, and relevant for learning physics in Islamic schools, especially in areas with a risk of landslides.


REFERENCES

- Anggereni, S., Rasyid, Muh. R., & Hasanah, I. U. (2019). PENGEMBANGAN BAHAN AJAR FISIKA TERINTEGRASI ISLAM-SAINS UNTUK PESERTA DIDIK. *Al Asma : Journal of Islamic Education*, 1(1), 1. <https://doi.org/10.24252/asma.v1i1.11253>
- Angraini, N., Nazip, K., & Andriani, D. S. (2021). Pengembangan Bahan Ajar Berorientasi Environmental Sustainability Education Berbasis Literasi Sains Dan Realitas Lokal Sumatera Selatan. *PENDIPA Journal of Science Education*, 5(3), 309–315. <https://doi.org/10.33369/pendipa.5.3.309-315>
- Ayub, S., Kosim, K., Gunada, I. W., & Utari, L. P. (2021). MODEL PEMBELAJARAN MITIGASI BENCANA TANAH LONGSOR DI SEKOLAH DASAR LERENG GUNUNG RINJANI. *ORBITA: Jurnal Pendidikan Dan Ilmu Fisika*, 7(2), 406. <https://doi.org/10.31764/orbita.v7i2.4936>
- Dewi, N. R., & Arini, F. Y. (2018). Uji keterbacaan pada pengembangan buku ajar kalkulus berbantuan geogebra untuk meningkatkan kemampuan pemecahan masalah dan representasi matematis. *PRISMA, Prosiding Seminar Nasional Matematika*, 1, 299–303. <https://journal.unnes.ac.id/sju/index.php/prisma/article/view/19592>
- Diani, R., Kesuma, G. C., Diana, N., Yuberti, Anggraini, R. D., & Fujiani, D. (2019). The Development Of Physics Module With The Scientific Approach Based On Islamic Literacy. *Journal of Physics: Conference Series*, 1155, 012034. <https://doi.org/10.1088/1742-6596/1155/1/012034>
- Dzakiya, N. (2021). *Pengantar Geofisika Eksplorasi (1st ed.)*. AKPRIND PRESS.
- Febrianti, Y., Sinaga, P., & Feranie, S. (2022). Pengembangan bahan ajar komik fisika berbasis pendekatan kontekstual pada materi hukum Newton. *WaPFI (Wahana Pendidikan Fisika)*, 7(1), 11–20. <https://doi.org/10.17509/wapfi.v7i1.43954>
- Jannah, M. M., Herawati, H., & Jumadi, J. (2022). IMPLEMENTASI PERANGKAT PEMBELAJARAN FISIKA TERINTEGRASI MITIGASI BENCANA BANJIR SAAT PANDEMI COVID-19. *Jurnal Pendidikan Fisika*, 10(1), 1. <https://doi.org/10.24127/jpf.v10i1.4701>
- Midroro, J. N., Prastowo, S. H. B., & Nuraini, L. (2021). ANALISIS RESPON SISWA SMA PLUS AL-AZHAR JEMBER TERHADAP MODUL FISIKA DIGITAL BERBASIS ARTICULATE STORYLINE 3 POKOK BAHASAN HUKUM NEWTON TENTANG GRAVITASI. *JURNAL PEMBELAJARAN FISIKA*, 10(1), 8. <https://doi.org/10.19184/jpf.v10i1.23762>
- Penggabean, N. H., & Danis, A. (2020). *Desain Pengembangan Bahan Ajar Berbasis Sains*. Yayasan Kita Menulis.
- Rahmat, H. K., Kasmi, & Kurniadi, A. (2020). Integrasi dan Interkoneksi antara Pendidikan Kebencanaan dan Nilai-Nilai Qur'ani dalam Upaya Pengurangan Risiko Bencana di Sekolah Menengah Pertama. *Prosiding Konferensi Integrasi Interkoneksi Islam Dan Sains*, 2, 455–461. <http://sunankalijaga.org/prosiding/index.php/kiiis/article/view/440>
- Riefani, M. K., & Mahrudin. (2020). Validitas Panduan Lapangan (Field Guide) Matakuliah Zoologi Vertebrata Materi Aves. . *Prosiding Seminar Nasional Lingkungan Lahan Basah*, 5, 63–69. <https://snllb.ulm.ac.id/prosiding/index.php/snllb-lit/article/view/371>
- Sa'adah, R. N., & Wahyu. (2020). *Metode Penelitian R&D (Research and Development) Kajian Teoritis dan Aplikatif (Cetakan Ke)*. Literasi Nusantara.
- Saftina, I., Muttaqien, M., & Hadiansah, H. (2021). Pengembangan Bahan Ajar Berbasis Metode Studi Kasus Terintegrasi Nilai Islam. *Bioeduca : Journal of Biology Education*, 3(2), 135–145. <https://doi.org/10.21580/bioeduca.v3i2.6632>

- Santoso, R., & Wuryandani, W. (2020). Pengembangan Bahan Ajar PPKn Berbasis Kearifan Lokal Guna Meningkatkan Ketahanan Budaya Melalui Pemahaman Konsep Keberagaman. *Jurnal Ketahanan Nasional*, 26(2), 229. <https://doi.org/10.22146/jkn.56926>
- Saputra, A. A., Mercuriani, I. S., & Rini, D. P. (2023). *Android-based e-module of excretory system to improve high school students' engagement*. 020022. <https://doi.org/10.1063/5.0106505>
- Susilowati, S. (2017). Pengembangan Bahan Ajar IPA Terintegrasi Nilai Islam untuk Meningkatkan Sikap dan Prestasi Belajar IPA Siswa. *Jurnal Inovasi Pendidikan IPA*, 3(1), 78. <https://doi.org/10.21831/jipi.v3i1.13677>
- Utia, R., & Fauzi, A. (2021). The Validity Of The Integrated Physics Ebook On Landslide Disaster Mitigation Materials Based On A Problem Based Learning Model. *International Journal of Progressive Sciences and Technologies*, 25(1), 630. <https://doi.org/10.52155/ijpsat.v25.1.2731>
- Vitrianingsih, D., Aulianingsih, I., & Yuliani, H. (2021). Analisis Kebutuhan Pengembangan Modul Elektronik (E-Module) IPA Terintegrasi Islam. *Jurnal Ilmiah Pendidikan Fisika*, 5(1), 27. <https://doi.org/10.20527/jipf.v5i1.2525>
- Wardani, M. A., Faiz, A., & Yuningsih, D. (2021). Pengembangan Media Interaktif Berbasis E-Book Melalui Pendekatan SAVI Pada Pembelajaran IPA Kelas IV Sekolah Dasar. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, 5(2), 230. <https://doi.org/10.20961/jdc.v5i2.53734>
- Zainuddin, Z., Astuti, R. D., Misbah, M., Wati, M., & Dewantara, D. (2020). Pengembangan modul pembelajaran generatif materi fluida statis terintegrasi ayat-ayat Al-Qur'an. *Jurnal Pendidikan Informatika Dan Sains*, 9(1), 1–12. <https://doi.org/10.31571/saintek.v9i1.1539>

BIOGRAPHIES OF AUTHORS

	<p>Muhammad Gibran Alif Prasetya Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universtas Negeri Semarang Email: gibranrmn@gmail.com</p>
	<p>Dr. Drs. M. Aryono Adhi, M. Si Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang Email: aryono_adhi@mail.unnes.ac.id</p>
	<p>Dr. Budi Naini Mindyarto, M. App. Sc Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang Email: budinaini@mail.unnes.ac.id</p>

	<p>Dr. Langlang Handayani, M.App.Sc. Physics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang Email: langlanghandayani@mail.unnes.ac.id</p>
---	---