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DEVELOPMENT OF E-GANER (ELECTRONIC GEOGRAPHY CORNER) ON DISASTER MITIGATION AND ADAPTATION MATERIALS

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ABSTRACT

Abstract: In modern education, digital technology is utilized to enhance learning activities and promote the development of the 4C skills: critical thinking and problem-solving, creativity, and innovation, communication, and collaboration. This research aims to develop and evaluate the feasibility of e-Ganer instructional materials, which concentrate on disaster mitigation and adaptation topics. The research methodology utilized in this study is research and development (R&D), following the A.D.D.I.E. model. Data collection is performed through non-test methods, specifically employing needs analysis and teaching material feasibility questionnaires. Data analysis is conducted using quantitative descriptive techniques. The e-Ganer product assessment yielded an average score of 94% from the material expert and 87.4% from the teaching material media expert. The product trial with teachers scored 83.3%, while the trial with students scored 85%. As a result, the e-Ganer teaching material is categorized as highly feasible and can be utilized in the educational process to support the achievement of learning objectives. Suggestions for further research include improving digital teaching materials in other subjects based on the need for teaching material development and evaluating the effect of using digital teaching materials on student learning outcomes to support the achievement of learning objectives.

Keywords: Development; Teaching materials; e-Ganer; Disaster Mitigation and adaptation.

Abstrak: Pada pendidikan kontemporer, teknologi digital dimanfaatkan untuk mendukung kegiatan pembelajaran dan mendorong pengembangan keterampilan 4C (berpikir kritis dan pemecahan masalah, kreativitas dan inovasi, komunikasi, dan kolaborasi). Penelitian ini bertujuan untuk mengembangkan dan mengkaji kelayakan bahan ajar e-Ganer yang difokuskan pada materi mitigasi dan adaptasi bencana. Metodologi penelitian yang dimanfaatkan ialah penelitian dan pengembangan (R&D) dengan menggunakan model A.D.D.I.E. Pengumpulan data dikerjakan melalui metode non-tes, dengan menggunakan analisis kebutuhan dan kuesioner kelayakan bahan ajar. Analisis data dikerjakan dengan menggunakan teknik deskriptif kuantitatif. Rata-rata hasil penilaian produk e-Ganer oleh ahli materi memperoleh skor 94%, oleh ahli media bahan ajar memperoleh skor 87,4%, uji coba produk kepada guru memperoleh skor 83,3%, dan uji coba produk kepada siswa memperoleh skor 85% sehingga bahan ajar e-Ganer termasuk dalam kategori sangat layak dan dapat dimanfaatkan dalam proses pendidikan untuk membantu mencapai tujuan pembelajaran. Saran untuk penelitian selanjutnya adalah penyempurnaan bahan ajar digital untuk mata pelajaran lain berdasarkan kebutuhan pengembangan bahan ajar serta evaluasi pengaruh penggunaan bahan ajar digital terhadap hasil belajar siswa untuk mendukung ketercapaian tujuan pembelajaran.

Kata Kunci: Pengembangan; Bahan ajar; e-Ganer; Mitigasi dan adaptasi bencana.

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A. INTRODUCTION

The rapid advancement of technology has significantly transformed various aspects of life, including academia (Ambarwati et al., 2021). Digital technology plays a crucial role in education by enabling teachers to present materials in a contextual, visual, engaging, and interactive manner. It also fosters learning that actively involves students (Rusydiyah et al., 2020). In 21st-century education, active learning is the primary focus, emphasizing implementing the 4C skills: critical thinking and problem-solving, creativity and innovation, communication, and collaboration (Hidayatullah et al., 2021). Therefore, teachers must be creative and innovative in organizing learning activities, including selecting teaching materials that effectively support student learning activities (Susilo & Sofiarini, 2020).

Teaching materials are fundamental elements that assist in achieving learning objectives. These materials consist of a set of educational tools that include learning content, methods, constraints, and evaluation techniques, all of which are systematically organized and designed to be engaging in order to achieve educational goals (Elvarita et al., 2020). Teaching materials should, at a minimum, include study guidelines, the competencies to be achieved, supporting information, exercises, and evaluation (Ernawati et al., 2024). Enhancement of teaching materials is necessary, particularly at the secondary school level, to promote more effective and interactive learning activities (Wahyudi, 2022).

Observations at M.A.N. 1 Malang indicate that learning activities in Geography are conducted conventionally. Teachers infrequently integrate digital-based teaching materials into their instruction and continue to rely on government-issued textbooks, which are general. Additionally, they deliver content using the lecture method, supported by PowerPoint presentations (Sari et al., 2020). The needs analysis of teaching materials revealed that students prefer digital teaching materials, including images, maps, and videos (Alperi, 2020). Additionally, due to storage limitations, students prefer digital teaching materials that only require a little storage space on their devices (Primandhika & Syihabuddin, 2021).

A lack of innovation in educational practices results in learning activities that are less engaging for students (Sukma & Handayani, 2022). Technological advancements should facilitate the introduction of various innovations in learning activities to achieve student engagement in active learning (Ambarwati et al., 2021). Therefore, it is essential to develop effective teaching materials that actively engage students and promote independent learning to improve the quality of education and enhance student competence

(Maysyaroh et al., 2022).

Curriculum analysis indicates that students must understand the material in geography courses, particularly disaster mitigation and adaptation. Learning about disaster mitigation and adaptation is crucial, given that Indonesia is highly susceptible to disaster threats due to its geographical location and demographic factors (Widodo & Mukminan, 2018). The relevance of the material to Indonesia's geographical conditions necessitates that it be easily accessible and studied at any time and place through the use of technology, specifically in the form of a website. Furthermore, utilizing a website allows disaster mitigation and adaptation material to be accessed without limitations of space and time. Therefore, it is essential to enhance digital teaching materials on disaster mitigation and adaptation to support student learning activities (Febrianto et al., 2021a).

Effective teaching materials can increase students' interest in learning, as demonstrated by Kusumadewi (2020), student's interest in learning increased after using digital-based mathematics teaching materials compared to before their implementation. Geography teaching materials at the high school level also need to adapt to this approach, and teaching materials based on Google Sites are considered effective in promoting students' interest and self-directed learning (Lukum et al., 2022).

Research by Hati and Setiaji (2024) demonstrates that teaching materials based on Google Sites can support students' self-directed learning. Google Sites can actively engage students during the teaching and learning process, enabling them to explore and discover material concepts independently. Previously available resources from teachers can now be accessed independently by students through websites created using Google Sites (Malau & Juniar, 2020; Nurlatifah & Suprihatiningrum, 2023).

Based on this background, the researcher is interested in conducting a study titled "Development of e-Ganer (Electronic Geography Corner) on Disaster Mitigation and Adaptation Materials." E-Ganer is a digital teaching material based on Google Sites (Amarta, 2022). Google Sites-based teaching materials can optimize the studying process (Purnama & Ardiansyah, 2023). Research by Imrotin (2022) indicates that Google Sites-based anecdotal text materials support the development of 4C skills in the learning process. Developing e-Ganer teaching materials for disaster mitigation and adaptation is necessary to foster 4C skills and enhance the use of technology in education. This approach allows students to access the latest information on disaster mitigation and adaptation through various features of the e-Ganer materials. This research aims to develop and assess the feasibility of e-Ganer teaching materials for disaster mitigation and adaptation. The outcomes of this research are expected to provide valuable insights for educators in designing teaching materials that integrate technology into learning and promote active student engagement, thereby supporting the achievement of learning objectives. (Abulibdeh et al., 2024).

B. METHOD

1. Development Method

This research employs the Research and Development (R&D) method using the A.D.D.I.E model, which is tailored to the needs of researchers as a foundation for enhancing teaching materials. The A.D.D.I.E research procedure consists of five steps: analysis of teaching material needs, product design, product development, product implementation, and evaluation (Dwitiyanti et al., 2020).

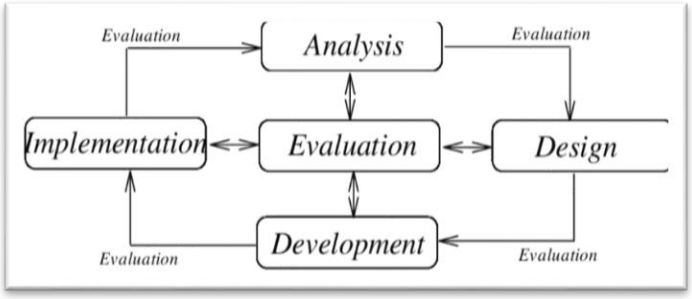


Figure 1: Flow chart of ADDIE research model
(**Source:** Branch, 2010)

The procedure of the A.D.D.I.E. model (figure 1) includes: 1) The objectives of the analysis stage are to assess students' learning conditions and identify the needs of both students and teachers in educational activities. Developing teaching materials necessitates conducting a curriculum analysis, analyzing the student body, and evaluating the teaching materials currently utilized in schools. The results of this need assessment form the foundation for developing a comprehensive plan for teaching materials development (A. Putra & Syarifuddin, 2019). 2) The design stage involves planning the organization of teaching material items based on the outcomes of the needs assessment previously conducted by researchers. The applied framework includes features that will be utilized, instructional objectives, presented materials, supplementary information, and learning evaluations. 3) The development stage involves implementing the planned structure by creating Google Sites. During this stage, the validation process is also conducted. Product validation is performed by specialists to assess the teaching materials, allowing for the identification of their strengths and weaknesses (Amalia et al., 2022). 4) The implementation stage is conducted on research subjects to evaluate the usability of these teaching materials and gather feedback through questionnaires. The participants in this evaluation included geography teachers and 40 eleventh-grade students from M.A.N. 1 Malang, selected through purposive sampling. 5) The evaluation stage is based on the outcomes of the questionnaires distributed to validators and research subjects. Researchers will use the results of this evaluation as a reference for improving e-Ganer teaching materials.

2. Data collection and analysis methods

The data collection method employs non-test instruments, specifically a needs analysis questionnaire and a teaching material feasibility questionnaire. Interviews with teachers and student perception questionnaires were conducted to describe students' learning conditions and to identify the needs of students and teachers in developing teaching materials. This research utilizes product validation sheets and questionnaires to collect data necessary for assessing product feasibility. The questionnaire is structured with a checklist system that includes researcher-formulated questions and provides a space at the bottom for suggestions or feedback. The items in the questionnaire are designed using a Likert scale ranging from 1 to 5. The validation sheet is directed to subject matter experts and specialists in instructional media (Wulandari, 2017). Electronic geography corner teaching materials are evaluated in schools using a questionnaire administered to geography teachers and eleventh-grade students at M.A.N. 1 Malang (Muzaki & Mutia, 2023).

The quantitative descriptive analysis method was employed for data analysis in this research. This method involves processing data quantitatively to produce data in percentage format. Subsequently, the data presented as percentages is interpreted and represented as a qualitative descriptive narrative (Widarto et al., 2023).

3. Validity assessment method

The results of the item assessments conducted by validation specialists and research subjects are then calculated and analyzed. A Likert scale (1-5) is used to evaluate and analyze the responses collected through the trial questionnaire, with the following categories: Very Infeasible/Very Impractical (1), Infeasible/Impractical (2), Moderately Feasible/Moderately Practical (3), Feasible/Practical (4), and Very Feasible/Very Practical (5) (Susanti et al., 2023). The percentage value is then calculated using the following formula:

$$\mathrm{P} = \frac{\sum x}{\sum x_i} \times 100\% \qquad (1)$$

Description:

P = Percentage value

$\sum x$ = Number of values fullfilled

$\sum x_i$ = Maximum number of values

The percentage value of the instrument is determined based on the results of the validation and trial instrument analysis. The interpretation is feasible if the evaluation instrument achieves a percentage of ≥ 61% (Setiawan et al., 2021). Improvements were made based on the comments and suggestions from the validators. The categories for interpreting the percentage value of the evaluation instrument are presented in Table 1.

Table 1. Interpretation of the feasibility value and practicality of teaching materials

Value	Feasibility	Practicality
81%-100%	Very Feasible	Very Practical
61%-80%	Worth	Practical
41%-60%	Decent Enough	Practical enough
21%-40%	Less Feasible	Less Practical
0%-20%	Very Less Feasible	Very Less Practical

Source: Setiawan (2021)

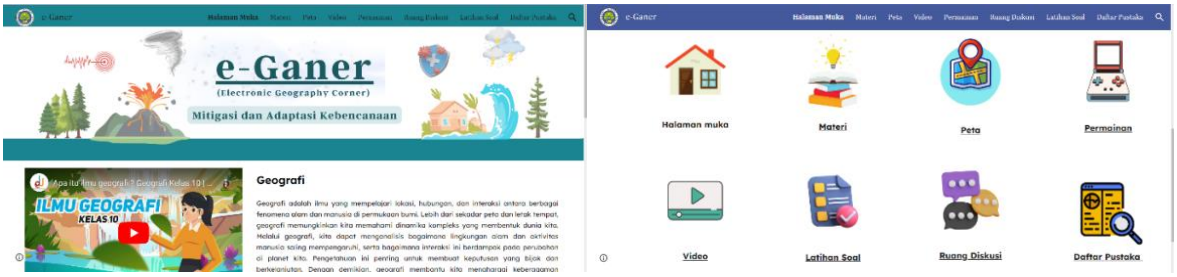
C. RESULT AND DISCUSSION

1. Results of the development of e-Ganer teaching materials

E-Ganer (electronic geography corner) is a teaching material developed on Google Sites, incorporating various features that facilitate the interactive and easily accessible delivery of information. This resource supports the development of the 4C skills (critical thinking and problem-solving, creativity and innovation, communication, and collaboration) that are essential for students (Aldresti & Haryati, 2023). This e-Ganer teaching material is an innovative resource enhanced with appropriate strategies to attract students' interest and encourage their continued engagement in learning, thereby facilitating the understanding of educational content and supporting the achievement of learning objectives. The website, developed using Google Sites, allows for the updating of information, enabling students to access the latest materials on disaster mitigation and adaptation (Widodo & Mukminan, 2018).

The novelty of the e-Ganer teaching material, compared to previous teaching material, lies in several aspects. Firstly, this material is enhanced with more detailed content on disaster mitigation and adaptation, including information on disaster threats and mitigation steps specific to the research location (Wardani & Suniasih, 2022). Secondly, the content of the teaching materials is comprehensive, encompassing learning outcomes and objectives, detailed descriptions of the material, usage instructions, maps, videos, games, exercises, and bibliographies. Thirdly, these teaching materials are designed with an attractive and dynamic appearance, facilitating students' mastery of the subject matter in an easy, straightforward, and meaningful manner (Maryana et al., 2024).

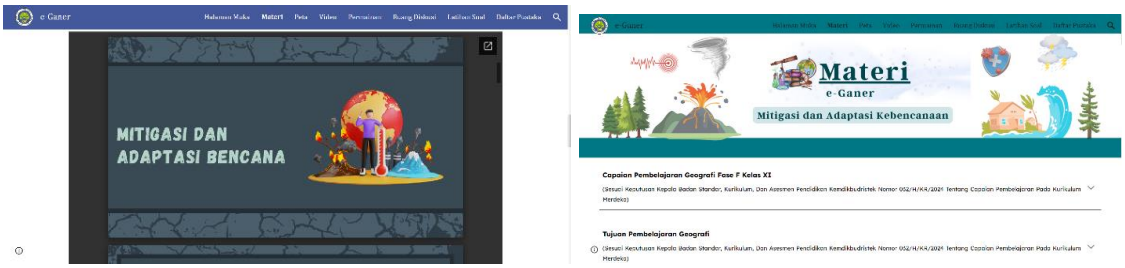
In the initial display of the electronic geography corner teaching materials (Figure 2), there is a brief explanation of geography study. The author included this explanation because disaster mitigation and adaptation material is one of the critical topics in geographic research (Sholichah et al., 2023). Additionally, e-Ganer, an acronym for "electronic geography corner," provides users with a brief explanation of geography studies. The initial display of the electronic geography corner also features various menu options, including the home page, material, map, video, discussion room, game, evaluation, and bibliography.



a. Initial view of e-Ganer b. Features of the e-Ganer menu

Figure 2. Main view of electronic geography corner teaching material
Source: Personal processed data

The subsequent section features the materials chapter in the electronic geography corner (Figure 3), encompassing content on the definition of disasters, disaster mitigation and adaptation, and landslide mitigation and adaptation specific to the Malang district. Additionally, each topic includes a reflection activity to assess how students have comprehended and internalized the material. This reflective practice serves as a foundation for deepening and improving the quality of the learning process, thereby rendering the educational experience more comprehensive and interactive (Wowor et al., 2022).



a. CP, TP, ATP, and IP of components on e-Ganer b. Material on e-Ganer

Figure 3. Material features of electronic geography corner
Source: Personal processed data

The electronic geography corner includes an interactive map feature (Figure 4), which integrates disaster maps from the InaRISK website. This feature enables students to examine the region's characteristics while making various decisions, such as identifying disaster threats in the surrounding environment and determining the necessary disaster management efforts (Febrianto et al., 2021). The activity promotes creativity and the utilization of technology in the learning process (Basiran & Ningsih, 2023).

Figure 4. Electronic geography corner map feature
Source: Personal processed data

Another feature of the electronic geography corner is the provision of supplementary information to reinforce students' understanding of the material through video features (Figure 5) (Rachma et al., 2023).

Figure 5. Electronic geography corner video feature
Source: Personal processed data

The electronic geography corner includes a game feature (Figure 6). This feature aims to enhance learners' interest in studying through an interactive and enjoyable approach (Vista et al., 2023). Additionally, this feature aims to serve as an initial (formative) assessment to evaluate the student's level of understanding (Yuliatun et al., 2023). The game feature in the electronic geography corner supports the development of critical thinking and problem-solving skills by encouraging learners to enhance their creative and effective problem-solving strategies (Qibtiyah et al., 2023).

Figure 6. Electronic geography corner game features
Source: Personal processed data

The electronic geography corner includes a discussion room (Figure 7). The objective of this feature is to strengthen communication and collaboration skills by facilitating the collaborative exchange of ideas among learners (Park et al., 2023).

Figure 7. Features of the electronic geography corner discussion room
Source: Personal processed data

The next feature in the electronic geography corner is the assessment or evaluation of the final material (Figure 8). The objective of this assessment feature is to serve as a final (summative) evaluation to determine the students' level of understanding of disaster mitigation and adaptation material covered in all chapters (Budiono & Hatip, 2023).

Figure 8: Evaluation feature of electronic geography corner
Source: Personal processed data

The final feature in the electronic geography corner is the bibliography (Figure 9). This feature enables users to access information sources relevant to the study material (Anggraeni et al., 2022).

Figure 9: Bibliography feature of electronic geography corner
Source: Personal processed data

2. Results of Testing the Level of Validity of e-Ganer Products

Subject matter experts and instructional material media specialists validated the feasibility test of e-Ganer teaching materials. The resulting teaching materials are feasible if the final interpretation of the computation outcomes of the evaluation instrument is ≥ 61% (Nafidah & Suratman, 2020). After being reviewed by specialists, enhancements will be made according to the validators' notes to improve the product standards.

a) Subject matter experts validate the feasibility of the disaster mitigation and adaptation teaching materials by assessing five aspects, which are divided into twelve indicators. Subject matter experts also provide suggestions and opinions for improving the teaching materials. The results of the assessment are presented in Table 2 below.

Table 2. component specialist Assessment outcomes

No	Assessment Indicator	Many Items	Percentage	category
1	Image Suitability	2	90%	Very Feasible
2	material Suitability	4	100%	Very Feasible
3	material Sequence	2	90%	Very Feasible
4	Sequence of text or exercises	2	90%	Very Feasible
5	Ease of material features	2	100%	Very Feasible
Average			**94%**	**Very Feasible**

The overall assessment of the teaching materials by subject matter experts received a score of 94% across twelve assessment indicators, categorizing it as highly feasible. This aligns with the research of Tanjung (2015), which emphasizes that educators must enhance teaching materials to meet the needs of students and promote

environmental awareness in their living context. The material presented in the electronic geography corner is consistent with learning outcomes, learning objectives, and assessment indicators, and it fosters environmental awareness among students. The subject matter expert validators suggest adding sources for materials that use quotations.

b) Validation of the feasibility of the e-Ganer teaching materials on disaster mitigation and adaptation, conducted by teaching material media specialists, involves using the electronic geography corner and assessing several indicators (Putra & Nurafni, 2021). The outcomes of the assessment of the teaching materials by teaching material media specialists are presented in Table 3 below.

Table 3. outcomes of Media Expert Assessment of teaching materials

No.	Assessment Indicator	Many Items	Percentage	Category
1.	Identity of teaching materials	1	80%	Very Feasible
2.	material feasibility	5	92%	Very Feasible
3.	Linguistics	4	90%	Very Feasible
4.	Retrieved	4	95%	Very Feasible
5.	Graphics	2	80%	Very Feasible
Average			**87,4%**	**Very Feasible**

The overall assessment of the teaching materials by teaching material media specialists received a score of 87.4% across sixteen assessment indicators, categorizing it as highly feasible. Based on the validation tests conducted, the feasibility of the e-Ganer teaching materials was determined to be 94% according to subject matter experts and 87.4% according to teaching material media specialists. Overall, the feasibility of the e-Ganer teaching materials, as evaluated by specialists, is 90.7%, which is interpreted as very feasible.

3. e-Ganer Product Trial Results

The implementation and testing of the electronic geography corner teaching materials are conducted to gather feedback and suggestions from teachers and students to improve product quality. Based on this feedback, further revisions will be made. The final revision represents the concluding stage of the product development, ensuring it is suitable for use in geography education. Ideal teaching materials provide information and learning experiences enhanced by good organization and features (Utami, 2019). The outcomes of the teaching material trial by the teacher are as follows:

Table 4. Teacher response outcomes

No	Aspects	Percentage	Category
1.	Material	80%	Practical
2.	Usability	80%	Practical
3.	Usage	90%	Very Practical
4.	Media Suitability	80%	Practical

5.	Visual	86,6%	Very Practical
	Average	**83,3%**	**Very Practical**

Based on the outcomes of the teacher trial, the percentage achieved was 83.3%, which falls within the 81%-100% range, categorizing it as very practical. Comments and suggestions from the teacher indicated that the material is feasible for use as teaching materials, with the recommendation to continuously update features and content according to current conditions to keep students motivated in their studies. In addition to teacher testing, the electronic geography corner teaching materials were also implemented and tested on students.

The outcomes of the implementation and product trials with students achieved a percentage of 85%, which falls within the 81%-100% range, indicating that it is in the convenient category. Students reported that the enhanced teaching materials aided their learning process because they used communicative, clear, and easy-to-understand language. Teaching materials that are easy to comprehend significantly facilitate the student learning process (Thalib et al., 2020).

Figure 10. Implementation and trial of electronic geography corner teaching materials
Source: Personal processed data

Considering the overall outcomes of this research, the interpretation of the validity results from specialists and research subjects achieved excellent results. Therefore, the e-Ganer teaching materials on disaster mitigation and adaptation are valid and suitable for use in the learning process. Suggestions for further research include the enhancement of digital teaching materials for other subjects that require them, based on the needs for teaching material development, and the evaluation of the impact and influence of the use of digital teaching materials on student learning outcomes to support the achievement of learning objectives.

D. CONCLUSION

The outcomes of this research align with the research objectives, demonstrating that the researchers have successfully developed e-Ganer teaching materials (electronic geography corner) on disaster mitigation and adaptation. These teaching materials have been evaluated by experts in their fields and tested on research subjects, demonstrating high feasibility. Consequently, e-Ganer can be effectively used in the learning process to support achieving learning objectives. The advantages of e-Ganer teaching

materials include various features that facilitate interactive information delivery, ease of access, and the enhancement of 4C skills (critical thinking, creativity, collaboration, and communication), which are essential for students. Additionally, these materials allow for updated information, enabling students to access the latest disaster mitigation and adaptation content. Therefore, it is crucial for academic institutions, through teachers, to embrace technology and integrate it into learning activities.

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