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Enhancing High School Geography Learning through a TikTok-Based E-Module on Flood Disaster Mitigation

Roisyah Budiati*, Erni Suharini, Edi Kurniawan, & Apik Budi Santoso

Department of Geography Education, Semarang State University, Indonesia

*Corresponding email: roisyahroisyah9@students.unnes.ac.id

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Abstract: Enhancing High School Geography Learning through a TikTok-Based E-Module on Flood Disaster Mitigation. Objective: The research aims to accomplish the following objectives: to compile design and feasibility, to explain the learning process, to determine the influence, and to provide an evaluation of the learning effectiveness. **Methods:** Techniques for quantitative data analysis were utilized in the research and development part of the methodology. A needs analysis, drafting, gathering references, assembling media, and evaluation are some of the findings that emerged from the study undertaken for the design compilation. There are three stages that make up the learning process: planning, implementation, and evaluation. **Findings:** The results of the students' learning on the pre-test (38%) and the post-test (79%) demonstrate the impact that the use of e-modules and videos from TikTok has had on their understanding. It can be concluded that the e-module media for flood catastrophe mitigation based on TikTok videos has an effect on the learning outcomes of students, as indicated by the mean result of 0.001. The n-gain test of the control class yielded a result of 31.1, which indicates that the class is considered ineffectual. It is determined that the experimental class has an n-gain of 56.4, which is considered to be extremely effective. Because of this, the use of e-module media for the mitigation of flood disasters based on videos from TikTok is more effective than the utilization of module media and films from YouTube. **Conclusion:** The conclusion is that the e-module for flood catastrophe mitigation that is based on videos from TikTok should be utilized more frequently as a source for studying geography. This is due to the fact that YouTube videos have been shown to be helpful in boosting learning outcomes.

Keywords: tiktok-based e-module, flood disaster mitigation, geography learning.

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INTRODUCTION

Natural disasters, including flooding, can be precipitated by vulnerabilities, hazards, and triggers (Suharini et al., 2015). Changes in land use patterns (Phouratsamay et al., 2024) and inadequate disaster management (Nyam et al., 2024) can result in floods. Facilities and infrastructure may be damaged, valuables may be lost, sustainable development, the community economy, and the emergence of a variety of health issues may be impeded by floods (Kurniawan et al., 2021; Taryana et al., 2022).

During periods of heavy rainfall, Merauke Regency is one of the regions in Indonesia that is susceptible to inundation. This occurs due to its location in the lowlands, which presents obstacles to the passage of water from upstream to downstream (Sari, 2024). Also on March 17, 2019, Merauke Regency was affected by floods, necessitating the evacuation of 300 residents

(Supriyadi & Reski, 2021). Merauke Regency's National Disaster Management Agency reported that the flood of 2024 transpired in Kurik District on May 7. A total of 836 houses that were mildly damaged, 6 houses that were moderately damaged, and 485 hectares of agricultural land were affected by the flood.

The flood disaster in Merauke Regency also had an impact on the education sector, such as what happened to Senior High School 1 Kurik, the only high school in Kurik District. Due to the flood disaster, most students were unable to participate in teaching and learning activities because they had to be evacuated. When viewed from the location aspect, Senior High School 1 Kurik also has a risk of flooding due to high rainfall during the rainy season, inadequate drainage infrastructure, and the location of Senior High School 1 Kurik. Through such problems, flood disaster mitigation measures are needed.

Mitigation is a series of activities carried out to reduce the risk of disaster. Mitigation is divided into structural and non-structural (Suharini et al., 2023). Structural mitigation includes disaster risk reduction efforts using building technology and techniques (Suharini et al., 2020). While non-structural mitigation is conducted through government policies and regulations (Kurniawan & Suharini, 2021). Mitigation that can be done by Senior High School 1 Kurik is non-structural. This mitigation is given to students by providing an understanding of the actions when a flood occurs and how to prevent the flood (Hayati et al., 2019). Moreover, the understanding can be provided through learning media or interesting teaching materials.

The results of observations conducted at Senior High School 1 Kurik indicate that the form of mitigation is taught by teachers through YouTube and disaster mitigation modules, which includes materials related to mitigating various categories of disasters. As a result, the module's presentation remains devoid of innovation. There is a scarcity of images and concrete examples in the module, and the majority of the materials are not comprehensively explained. Furthermore, it is determined that the YouTube videos utilized are exceedingly lengthy and conventional. This impacts students' academic performance. Of the 194 students in grade XI at Senior High School 1 Kurik who were assigned geography subjects, 65% were able to meet the minimum completion requirements. This information is widely recognized. It is essential to convert learning modules into e-modules in response to these concerns. E-module development must be founded on the learning materials and the characteristics of students in the present era, particularly the Generation Z era, which includes those born between 1997 and 2012.

The generation known as Gen Z was born during the digital era (Raman et al., 2024). In addition, researchers discovered that the majority of Generation Z students prefer to access TikTok media; nearly 90% of all grade XI students have access to TikTok. The reason for this is the contemporary popularity of TikTok. An innovation in the development of teaching materials is the potential for the modules available at Senior High School 1 Kurik to be converted into e-modules (Auwaliyah et al., 2023). Baek et al. (2024); Sari et al. (2022); Sidiq et al. (2021) have all posited that e-modules are systematically organized, visually appealing, have learning objectives, facilitate independent comprehension, and foster interaction among students.

The use of TikTok as an innovative e-module is supported by previous research, which states that TikTok is useful in supporting the achievement of learning objectives by increasing students' enthusiasm for learning and creativity in learning (Alexandro et al., 2022 ;Princess & Minsih, 2024). On the other hand, TikTok has challenges, such as students having the freedom to explore videos and this application can only be accessed using the Internet (Pebrimireni & Fauziya, 2024). The shortcomings in the TikTok video can be overcome by using e-modules. E-

modules can explain the contents of the material in the TikTok video, so students are free to choose whether to learn by reading the e-module or listening to the TikTok video. In addition, e-modules can also be accessed offline in PDF for.

The selection of TikTok media as a supporting media in the e-module has also been supported by the Internet network facilities available at Senior High School 1 Kurik and the availability of students' smartphones. Based on this phenomenon, the researcher tries to develop a conventional disaster mitigation module into a flood disaster mitigation e-module based on TikTok videos as a learning resource for class XI students at Senior High School 1 Kurik, Merauke Regency. It is expected that students can learn according to their learning style in the Generation Z era.

METHOD

This study employed a Research and Development (R&D) approach and was categorized as a quasi-experimental design using a nonequivalent control group format, in which the control and experimental groups were not randomly assigned (Anantasia & Rindrayani, 2025). The experimental group received instruction through an e-module incorporating TikTok-based videos, whereas the control group utilized a module based on YouTube content.

Participants

The population of this study was all class XI students, totaling 194 students. The sampling technique used to take samples was non-probability sampling with purposive sampling based on certain criteria, namely all class XI students who received geography subjects and who had the lowest KKM score (72). There are 29 students in class XI IPS 1 with an average score of 61 and 29 students in class XI IPS 2 with an average score of 61. The total sample was 58 students. The reason for choosing class XI IPS 1 and XI IPS 2 is that the two classes have the same level of understanding and intelligence. In addition, the two classes have balanced completeness scores.

Instrument

A cognitive domain test instrument was employed to gather data, which consisted of 20 multiple-choice questions to ascertain learning outcomes in accordance with Bloom's taxonomy. The questionnaire instrument was employed to ascertain student responses (Hairina et al., 2020), which encompassed a variety of indicators, including motivation, satisfaction, assessment, and response. An expert validation questionnaire instrument (Aprianto & Wahyudin, 2023), a media expert validation questionnaire instrument (Aprianto & Wahyudin, 2023), and a language expert validation questionnaire instrument (Nurlina et al., 2024) all employed indicators. Instruments for observation to ascertain the initial conditions of the research location and documentation to gather data regarding student grades, infrastructure, and facilities.

Research Design and Procedures

This research was a development research that refers to the steps of Analysis, Design, Development, Implementation, and Evaluation (ADDIE). The analysis stage consists of observation, problem identification, collecting documents, and solutions offered. The design stage carries out development (Andi Rustandi & Rismayanti, 2021). Development stage, namely the development of e-modules and TikTok videos, e-modules were systematically arranged to discuss the flood disaster that occurred in Merauke and its surroundings, equipped with appropriate images, and there is a TikTok video barcode that students can scan. The TikTok video presents a more detailed video about the problems discussed in the e-module, explained in detail, briefly, concisely, and easily understood. The next stage was validation of media experts by media expert lecturers, validation of material

experts by all geography teachers at the research location, and validation of language experts by language experts in the field of disasters. Implementation stage, products that have passed expert validation tests are implemented in the experimental class. The implementation stage was carried out in 2 meetings, with a duration of each meeting of 2 x 45 minutes. In the experimental class, the researcher used e-module media based on TikTok videos that have been validated. While in the control class were modules in the form of books and YouTube videos that can be accessed by students via smartphones. Evaluation stage, evaluating the shortcomings and advantages of the media that have been tested on the experimental class (Sabdarini et al., 2021).

Data Analysis

Quantitative data analysis was employed to elucidate the effectiveness of the TikTok video-based e-module with respect to the questionnaire score criteria categories: very effective, effective, less effective, ineffective, and very ineffective. The data is subjected to a normality test using the chi-square formula to determine whether it is normally distributed. A homogeneity test is conducted to determine whether the data is homogeneous by examining the Sig value. A mean difference test is conducted to determine the difference in student learning outcomes. Finally, an n-gain score test is conducted to determine the effectiveness of the TikTok video-based e-module, which is graded as ineffective, less effective, quite effective, and effective.

■ RESULT AND DISCUSSION

Development of a Flood Disaster Mitigation E-Module Based on TikTok Videos: Design and Feasibility

Design is the initial phase of the e-module compilation process, which entails an assessment of the module's functionality and development requirements (Prasetya, 2021). The design comprises indicators for the analysis of requirements, the compilation of drafts, the collection of references, the compilation of e-modules, and the evaluation (Rendra, 2022). The flood catastrophe mitigation e-module's design process includes an analysis of the module's requirements. It is widely recognized that Senior High School 1 Kurik is experiencing challenges in terms of the necessity for digital-based learning media that are compatible with the characteristics of Generation Z students, who prefer to learn through technology, promote independent learning, and enhance learning outcomes (Jalil et al., 2025; Najuah et al., 2021; Mahmudah et al., 2022). The e-module's initial draft is generated, the cover is designed, the material is meticulously organized, and an appealing design is generated using the Canva application (Levett-Jones et al., 2024). The initial phase involves the collection of references, followed by the compilation of e-modules with a focus on the placement of images, audio, or video. The evaluation stage is conducted by material experts, media experts, and language experts (Erita, 2022).

The design of TikTok videos encompasses the stages of creating TikTok videos (Susilowati, 2018), which include the selection of images or concepts, TikTok videos that are related to natural disasters, such as floods, and the object recorded is the location where the flood disaster occurred, thus providing the audience with insight (Lemana et al., 2024). Quality information can be included in TikTok videos, which can be exhibited in high quality (Heales et al., 2025). Music filters are implemented in TikTok videos to entice pupils to view them (Nu'man et al., 2022). The TikTok video reduction stage entails the selection of videos that are appropriate for use. Afterward, an editing stage is implemented to ensure that the material presented aligns with the learning objectives by adjusting the video duration (López-Carril et al., 2024). The duration of TikTok recordings is limited to 60 seconds, and they are

edited accordingly (D'Ambrosi et al., 2025).The final step involves storing the video by uploading it to TikTok, adding keywords, and saving it to the storage of your laptop (Vitale et al., 2025). The feasibility test was conducted by linguists, material experts, and media experts to determine the suitability of the media you intend to use. The results are illustrated below.

Table 1. Expert validation tabulation

No	Expert validation	Score	Input	Information
1	Media Expert	88.75	It is necessary to incorporate sources from the BNPB pocket book on floods into the e-module.	Revision
2	Linguist	91.25	The title of the instrument sheet is Disaster Mitigation and Adaptation Material, while the title of the e-module is Flood Disaster Mitigation Based on TikTok. The title of the e-module contains the word TikTok-based, but the table of contents does not mention TikTok.	Revision
3	Subject Matter Expert	93.45	The material is appropriate	No Revision

The indicators utilized for media expert validation are obtained from (Aprianto & Wahyudin, 2023). The media expert validation achieved a score of 88.75 with very excellent criteria, but it requires revision. There are 20 indicators. Utilizing a set of seven indicators and two aspects (content feasibility and language use), three experts conducted the validation of material experts (Aprianto & Wahyudin, 2023). The material section is appropriate for high school students to use, as the validation of material experts from three experts yielded a score of 93.45 with very acceptable criteria and no comments. The validation of feasibility is conducted by language experts who employ indicators in accordance with Nurlina et al. (2024). These indicators consist of 10 indicators and 2 aspects, which are language presentation aspects and sentence presentation aspects. The score of 91.25 in the validation of language experts was achieved with very excellent criteria; however, it requires revision.

Learning Process Using Flood Disaster Mitigation E-Module based on TikTok Videos

The learning process consists of planning, implementation, and evaluation (Helmi, 2024).

Planning

The process of planning an experimental class involves preparing lesson plans, syllabi, and learning media for e-modules on flood disaster mitigation and TikTok. The e-modules and TikTok videos have been validated, well-designed, and equipped with content that encourages students to learn independently (Milla et al., 2021 ; Levett-Jones et al., 2024). The selection of TikTok videos has the advantage of being a means of disseminating knowledge, easy to share, and easy to access (Kim et al., 2025 ;Rahmawati et al., 2022). The learning model used is problem-based learning, by invites students to learn through flood disaster problems in their surroundings (Saputra et al., 2024). The planning

process in the control class is to prepare lesson plans, syllabi, and concrete objects used (Cahya & Bektiningsih, 2024) in the form of printed module learning media and YouTube learning videos. The learning model used in the control class is problem-based learning.

Implementation

E-disaster mitigation modules based on TikTok videos are employed to implement learning in the experimental class. The application of e-flood disaster mitigation modules that are based on TikTok videos is an ideal learning medium for students in the Generation Z era. This is due to the fact that the e-modules are visually appealing, contain real-world examples, and are equipped with images and videos, which facilitate independent learning (Alvia Quthrotun Nada et al., 2022; Aspridanel et al., 2022; Syahrial et al., 2020). According to Zhang, Q., Li et al. (2019), TikTok is employed to present material in video format, which facilitates comprehension for students.

The experimental class learning implementation phase, as per Malik et al. (2022), commences with all students having access to educational resources including TikTok videos and e-modules. The teacher explains the procedures for using the e-module and TikTok videos, and the students are invited to open the e-module link. The learning process of TikTok social media is enjoyable, as evidenced by the enthusiasm of students when they access TikTok videos. This is due to the fact that TikTok offers a variety of features that can captivate users (Nu'man et al., 2022). In addition, students are tasked with resolving flooding-related issues. The solutions are then debated among group members and presented in the form of puzzles and mental maps. The implementation of the control class learning process involves two meetings that utilize module media, including printouts and YouTube videos. The researcher first invites students to access the module, followed by an invitation to access YouTube learning videos. Subsequently, students are instructed to address flooding-related issues in their area, which are then presented in the form of mind mapping in front of the class.

Evaluation

The e-module used has the advantage of being easy, encouraging students to learn independently, not easily damaged, and equipped with pictures and examples of real problems, encouraging students to learn independently, directly proportional to the opinion(Jayanti & Pertiwi, 2023; Levett-Jones et al., 2024). The disadvantage of e-modules is that for students who have limited cellphone storage, it is difficult to access e-modules in PDF format, so students can access them in the form of links or can access e-modules with their deskmates. TikTok videos have the advantage of increasing students' understanding of learning about flood disaster mitigation, and making the learning process more enjoyable. This is in line with the opinion (Lemana et al., 2024), where TikTok can be used as a means of exchanging insights, in line with research (Aubryla et al., 2025) which features such as music on TikTok make its users interested in accessing TikTok media. TikTok's drawback is the limited duration of the video, so videos can only be uploaded in a few minutes (Pryde et al., 2024);Vincent Jones et al., 2024). This can be overcome by making videos that are concise, clear, educational, but still interesting (Nugrahani & Abduh, 2025;López-Carril et al., 2024).

Impact of TikTok Video-based Flood Disaster Mitigation E-Module on Learning Outcomes

Learning outcomes are obtained through pretest and posttest questions described as follows.

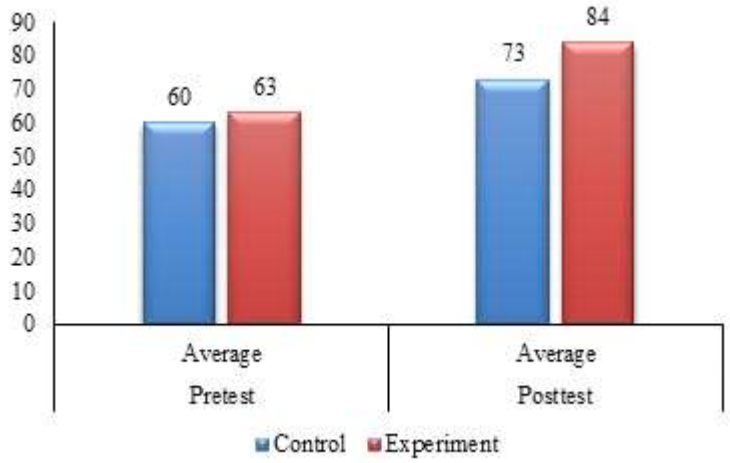

Figure 1. Student's learning outcomes (control and experimental group is presented in blue and red, respectively)

The pretest stage of the control class has an average score of 60, as indicated by the results. However, the average score increased to 73 after the treatment was administered using modules and YouTube videos. The average score of the experimental class at the pretest stage was 63. However, the average score increased to 84 after the treatment was administered using the e-module disaster mitigation media, which is based on TikTok videos. It can be inferred that the experimental class, which was administered the e-module disaster mitigation learning media based on TikTok, exhibited superior learning outcomes in comparison to the control class, which utilized conventional media. This is consistent with research (Putri, KE, & Wiguna, 2020) that indicates that courses that employ a variety of learning media will be able to enhance student engagement and enhance learning outcomes.

Table 2. T-Test results

	Levene's test		t-test		
	F	**Sig**	**T**	**df**	**Sig. (2-tailed)**
Equal variances assumed	.035	8.53	-3.545	56	.001
Equal variances assumed			-3.545	55.981	.001

It is evident from the table that the data exhibit a difference if the significance value is less than 0.05 and if there is an influence or difference between variables x and y. The sig value in the table is 0.001, indicating that it is less than 0.05. Next, the learning outcomes of students are influenced by the e-module media for flood disaster mitigation, which is based on TikTok videos and conventional models, as well as YouTube. The utilization of e-module media for flood disaster mitigation is associated with a greater improvement in learning outcomes, as evidenced by TikTok videos. The experimental class with treatment using Google Earth Pro is regarded to have more effective learning outcomes than the control class using PowerPoint, as per Suharini et al. (2020). In accordance with Aditya et al. (2023), the calculated t value exceeds the t table, and there is an increase both before and after the media was used. In summary, the media has an impact on the enhancement of learning outcomes.

Learning Effectiveness

Learning is considered effective when it meets the efficacy indicators of learning management, learning outcomes, student activities, and student responses (Juliantari et al., 2024). The planning, implementation, and evaluation stages comprise the learning process management (Helmi, 2024). In the planning process, the formulation of media to be used and a validation process by experts are both involved. A problem-based learning model is employed during the implementation process, in which students are tasked with resolving issues associated with flood disasters. These problems are presented in the form of mind mapping and puzzles (Uliyandari et al., 2021). The evaluation process is conducted through student assessments. During the evaluation phase, the e-module media for flood disaster mitigation is assessed in terms of its advantages and disadvantages, as evidenced by TikTok videos. The learning process achieved through the use of the e-module for flood disaster mitigation, which is based on TikTok videos, is effective due to the cognitive processes that are measured through test question instruments. This is consistent with the cognitive theory of meaningful learning media, which posits that it can rapidly organize information for students to understand, thereby influencing cognitive learning outcomes (Mayer, 2024). In accordance with Edgar Dale's cone of proximal development theory, the more effective method of learning is through direct experience related to natural disasters in the surrounding environment, with the assistance of TikTok as an audio-visual medium, and undertaking simulations (Rochmata et al., 2024).

In the learning outcome indicator, it is known that there is an increase in learning outcomes after being given treatment using the e-module for mitigating natural disasters based on TikTok videos. The number of students who met the KKM at the pretest stage was 11 students, then increased to 23 students. Moreover, the n-gain score test carried out using the pretest and posttest values, students have a mean value of 56.4, so it can be concluded that the e-module media for mitigating natural disasters based on TikTok videos is effective to use as a learning resource, in line with (Sulastri et al., 2023). The effectiveness of learning using the PBL model can be seen through the results of the pretest-posttest, which were analyzed using n-gain. There is an increase in student activity. Initially, the score is 619 with good criteria, then it increased to 648 with very good criteria.

Based on the questionnaire sheet, the result is that there are 23 of 29 (87.4%) students gave a very effective response. This happened because students felt that learning was more innovative and not monotonous (Roemintoyo & Budiarto, 2021). Therefore, it can be concluded that the e-module for flood disaster mitigation based on TikTok videos has met the effectiveness indicators according to (Juliantari et al., 2024). In line with research (Oktavia & Agustin, 2020) that positive and enthusiastic student responses indicate that the media has proven to be effective. Furthermore, an n-gain test of the experimental class score is 56.4, classified as moderate effectiveness. While, n-gain score of the control class was 31.1, classified as ineffective. Based on these results, the e-module media for flood disaster mitigation based on TikTok videos is more effective than the module media and YouTube videos.

This research is in line with research conducted by (Kurniawan & Trimasukmana, 2020), where the learning process uses audio-visuals in Korean dramas that are liked by students affects learning outcomes. In other words, the development of e-modules based on project-based learning is valid and proven to be effective in improving learning outcomes. Besides, e-modules have also proven to be practical, making it easier for students to learn independently(Lestari et al., 2022). In line with (Sukirman et al., 2022), effective learning is seen from a positive response from students, and there

is a change in higher learning outcome scores. In line with research (Budiati et al., 2024), the use of learning media that follows the characteristics of students in the Generation Z era, such as using Instagram as a learning medium, can improve students' learning outcomes and geography skills. Geography learning using e-modules based on TikTok videos can be integrated into the entire geography learning process because it can represent the geosphere phenomenon being studied in line with research (Andini & Suharto, 2024). Geography learning media is able to solve geosphere problems, and can increase emotional geography in the form of feelings of pleasure to make the learning process more enjoyable (Susanto et al., 2020).

■ CONCLUSION

The e-module design preparation process consists of the following stages: requirements analysis, drafting, reference collection, e-module compilation, and evaluation. The TikTok video design process commences with the selection of a concept, the recording of the video, the reduction process, the editing, and the storage of the video.

The planning stage of the learning process involves the development and evaluation of the feasibility of e-modules and TikTok. A pretest initiates the implementation phase. Subsequently, the experimental class implemented an e-module for flood calamity mitigation that was based on TikTok videos, while the control class implemented a conventional module that was equipped with YouTube videos. The evaluation procedure, which is associated with the media's advantages and disadvantages, is the terminal phase.

The impact of e-modules and TikTok videos on student learning is evident in the pretest results. Specifically, 38% of students completed the posttest, which increased to 79% of students who completed. The student learning outcomes were influenced by the e-module media for flood disaster mitigation, which was based on TikTok videos, as evidenced by a mean of 0.001 obtained from the t-test.

The n-gain score test results indicate the media's efficacy. The experimental class achieved a score of 56.4, which is classified as "quite effective," while the control class achieved a score of 31.1, which is classified as "not effective." Consequently, it is inferred that the learning outcomes of class XI IPS students at Senior High School 1 Kurik, Merauke Regency, are influenced by the e-module media for flood disaster mitigation, which is based on TikTok videos.

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