ABSTRACT

Technological advancements have profoundly reshaped educational paradigms, leading to an expansive array of instructional media. Nevertheless, empirical observations reveal educators’ hesitancy in assimilating these technologies, notably within geography instruction. Predominantly, geography pedagogy has gravitated towards memorization-based approaches, thereby constricting students' capacity to correlate academic content with their empirical experiences—a consequence of an entrenched reliance on conventional textbooks. Addressing this instructional void, our research endeavoured to devise an E-Comic media, underpinned by a contextual approach, to elucidate strategies for mitigating volcanic eruptions. The empirical setting for this study was situated at SMA PGRI 1 Lumajang. The research harnessed the Research and Development (R&D) methodology, employing the comprehensive ADDIE model. This model delineates five distinct phases: 1) Curricular, student demographic, and educator need analysis; 2) Storyboard conceptualisation for the impending product; 3) Product realisation in conformity with the established design; 4) Implementation, encompassing a rigorous vetting process by domain-specific expert validators and the intended research demographic. Evaluation metrics showcased robust approval ratings: 87% from media specialists, 97% from subject-matter experts, 95% from educator respondents, and 87% endorsement from student participants. In light of these affirmations, as conceptualised and developed in this study, the E-Comic medium is posited as an academically sound and pedagogically effective tool.

KEYWORDS

Contextual E-Comics, Geography Learning Media, Volcanic Hazard
INTRODUCTION

The meteoric rise of technological advancements has ushered in an era. Its profound influence permeates the educational landscape, particularly in the domains of instructional media and the evolution of technological knowledge (Nandi, 2006). This accelerating trajectory of technological growth heralds transformative shifts in societal structures and indelibly impacts human life and experiences (Khotimah, 2021). Consequently, the contemporary academic sphere is awash with various varied and innovative media, compelling educators to refine their pedagogical acumen, ensuring alignment with the ever-evolving global milieu (Hakim et al., 2017). As technology becomes increasingly sophisticated, the imperative to harness its potential to captivate student interest gains paramount significance, with diversified learning media as pivotal instruments in this endeavour (Firmadani, 2020).

E-Comics has emerged as a beacon of innovation within this dynamic educational tapestry. Distinctly digital, E-Comics transcend the limitations of their traditional print counterparts, offering unparalleled accessibility and convenience (Khotimah, 2021). While conventional comics necessitate a physical purchase, E-Comics obliterates geographical and temporal barriers, rendering them accessible online. In line with this paradigm shift, our research team has pioneered the development of a specialised geographical E-Comic tailored for dissemination on the ubiquitous Webtoon platform, ensuring its global reach across diverse platforms, from Android and iOS to web browsers, sans restrictive access prerequisites.

Our investigative purview is firmly anchored in natural disaster mitigation, with a pronounced emphasis on volcanic eruptions as a salient topic. This is predicated upon the foundational competency of critically analysing types and countermeasures of natural disasters, leveraging a triad of education, indigenous wisdom, and state-of-the-art technology. Preliminary fieldwork at SMA PGRI 1 Lumajang unveiled a conspicuous dearth of diverse instructional media, further exacerbated by a discernible student passivity during instructional sessions. Empirical observations underscored a pronounced student predilection for visually rich, illustrative academic resources.

To bring this vision of a contextually anchored E-Comic to fruition, we employ a meticulous manual sketching process, leveraging the capabilities of the ibisPaint X application (Chusniah, 2019). Esteemed for its compatibility with a wide array of devices and intuitive feature sets, ibisPaint X streamlines the comic creation continuum, from initial sketches to intricate refinements, colouring, and textual integrations. This concerted effort culminates in an instructive E-Comic centred on volcanic eruption mitigation, primed for global dissemination via the Webtoon platform.

Underpinning this endeavour are two cardinal objectives: (1) to elucidate the developmental trajectory of a contextually-oriented E-Comic, serving as an instructional linchpin for volcanic eruption mitigation in Class XI IPS, and (2) to rigorously assess the pedagogical viability and efficacy of a contextually-oriented E-Comic in enhancing instructional outcomes for volcanic eruption mitigation in Class XI IPS.
METHOD

The development strategy adopted in this research draws its foundation from the "Research and Development" (RnD) paradigm, employing the robust ADDIE model. This decision was predicated on the systematic and comprehensive nature of the ADDIE framework, which, as evidenced in prior studies, assures effective and efficient product development (Hakim, 2017). As elucidated by Sugiyono and further reiterated by Haryati (2012), the RnD method focuses on generating a specific product and subsequently appraising its effectiveness.

The ADDIE research model, adaptable to print and digital media development, is compartmentalized into five phases: Analysis, Design, Development, Implementation, and Evaluation (Melda, 2019). Notably, the scope of our media development extends only up to the implementation phase. The following delineates the ADDIE development model's sequential flow, as shown in Figure 1.

![ADDIE development model](image)

Figure 1. ADDIE development model

A dual-pronged survey strategy encompassing open-ended and closed-ended questionnaires was embraced in operationalizing this methodology. This approach facilitates the derivation of a feasibility score for the E-Comic currently under development, with respondents undertaking a checklist evaluation. The rationale behind employing closed-ended questionnaires is their quantifiable nature. In contrast, open-ended ones provide invaluable insights and feedback from diverse respondents, including media experts, subject matter specialists, teachers, and students. The product’s trial phase was conducted with educators at SMA PGRI 1 Lumajang and students of Class XI IPS 1 at the same institution, chosen specifically due to their prior exposure to Natural Disaster Mitigation in Geography. The empirical data amassed from expert validators and study subjects were subsequently transmuted into percentage form, employing the following formula:

\[ P = \frac{Total\ score}{Maximum\ score} \times 100 \]

The validation results, collated from expert media and subject matter respondents, alongside feedback from teachers and students, serve as a yardstick to assess the product’s feasibility. This feasibility assessment is then categorized based on predetermined criteria, as tabulated in Table 1.

<table>
<thead>
<tr>
<th>No</th>
<th>Feasibility Scale</th>
<th>Rating</th>
<th>Feasibility Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>90-100%</td>
<td>Excellent</td>
<td>Highly suitable</td>
</tr>
<tr>
<td>3</td>
<td>80-89%</td>
<td>Good</td>
<td>Suitable</td>
</tr>
</tbody>
</table>
The development is deemed satisfactory and valid by the table above and requires no further revisions if the media's achievement level surpasses 80%. Conversely, if the score attained falls below 80%, the media development is considered subpar or invalid, necessitating revisions to the product. This criterion ensures a stringent standard of quality and effectiveness for the developed media, aligning with international standards and best practices in pedagogical media development.

RESULT AND DISCUSSION

Analyse

The initial analysis phase is crucial to comprehend the existing conditions on the ground and discern students' needs. A meticulous observation of students during learning sessions was conducted, followed by an interview with the geography teacher at SMA PGRI 1 Lumajang. The interview revealed that the primary learning media revolves around PowerPoint presentations and videos. The development of the E-Comic aligns with the 2013 curriculum's Competency and Basic Competency standards. Moreover, the analysis encompasses challenges faced in the school, such as during learning activities and the evaluation of previous learning media, which becomes the focal point of the development.

Design

The design phase involves creating a storyboard for the media under development. Sketches are crafted at this stage to structure the E-Comic. The designs rely on insights gathered from the analysis phase, ensuring the E-Comic resonates with its intended purpose. The sketching phase refines the images, producing clear and effective visuals and sketching storyboard E-Comics, as shown in Figure 2.

![Figure 2. Sketching storyboard](image)

Development

During the development phase, the media is perfected based on designs from the prior stage. The narrative's structure, initially outlined in the storyboard, is solidified. This phase entails tailoring the product to students' needs and the
on-ground conditions. Here is a glimpse of the E-Comic that emerged from this development shown in Figure 3.

Figure 3. Cover and initial display of E-Comics

The E-Comic, designed for volcanic disaster mitigation, is an alternative classroom learning media. It introduces various topics related to disaster mitigation actions, incorporating information on a) disaster mitigation descriptions, b) processes of volcanic eruptions, c) disaster management cycles, and d) disaster management agencies. Employing a contextual approach, the E-Comic facilitates student understanding by integrating daily life experiences. This learning methodology aligns with the Student-Centered system, enabling students to associate school-acquired knowledge with their everyday experiences.

Implementation

The product's implementation stage introduces the E-Comic to teachers and XI-grade students. Before classroom utilization, experts in media and disaster mitigation validated the product. Their feedback and open and closed questionnaire responses from teachers and students shaped the product's refinements. The validation process helps determine the product's feasibility for broader deployment. The research's implementation was primarily conducted at SMA PGRI 1 Lumajang, XI IPS 1 class, involving 32 students and one geography teacher. The product underwent two revision cycles based on feedback from media experts, while content experts approved it without revisions. The result of expert media validation is shown on Table 2 and Table 3, and the result of content expert validation is shown on Table 4.

Table 2. Result of expert media validation Revision 1

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Score</th>
<th>Percentage</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic/Visual Display</td>
<td>88</td>
<td>40%</td>
<td>Highly Unsatisfactory</td>
</tr>
<tr>
<td>Text Display</td>
<td>9</td>
<td>45%</td>
<td>Highly Unsatisfactory</td>
</tr>
<tr>
<td>Media Functionality</td>
<td>15</td>
<td>70%</td>
<td>Unsatisfactory</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>10.6</strong></td>
<td><strong>52%</strong></td>
<td><strong>Highly Unsatisfactory</strong></td>
</tr>
</tbody>
</table>

Source: Research data, 2023

Table 3. Result of expert media validation revision 2

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Score</th>
<th>Percentage</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphic/Visual Display</td>
<td>19</td>
<td>95%</td>
<td>Excellent</td>
</tr>
<tr>
<td>Text Display</td>
<td>16</td>
<td>80%</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Media Functionality</td>
<td>17</td>
<td>85%</td>
<td>Satisfactory</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>17.3</strong></td>
<td><strong>87%</strong></td>
<td><strong>Satisfactory</strong></td>
</tr>
</tbody>
</table>

Source: Research data, 2023
Based on the scores derived from the media expert's validation concerning assessment components such as graphic/visual display, text presentation, and media functionality, the E-Comic learning media achieved a suitability percentage of 87%, qualifying it as "satisfactory." This assessment was derived from various criteria: the graphic/visual display secured a score of 95%, categorized as "highly satisfactory"; the text presentation in the E-Comic scored 80%, deemed "satisfactory"; and the media's functionality earned an 85% score, also rated as "satisfactory." Several recommendations and feedback from the media expert were noteworthy, and the result of the revision is shown in Figure 4.

1. Cover Design: The front cover of the E-Comic served merely as a background, failing to provide a realistic representation of a volcanic eruption. It was suggested that the cover be redesigned to depict a more authentic portrayal of a volcanic event.

2. Character Representation: Three characters on the cover were deemed unnecessary. A more focused and clear representation is advised to avoid clutter and ensure the primary theme of the E-Comic is evident at first glance.

3. Font Selection: The font used, especially for the title, should be bold and assertive to indicate its prominence. A clear and readable font can provide a more professional look and ensure that readers can easily identify the title from other text elements.

Figure 4. Cover before revision and after revision

In refining the narrative and design of the E-Comic, the following enhancements can be proposed based on the feedback. This enhancement is shown in Figure 5, Figure 6, and Figure 7.

1. Introduction to the story
   a. Begin with the main topic of discussion without veering into unrelated preliminary activities. The narrative can open with a scene in a geography class where students are grouped and tasked with analyzing natural disasters around their residences.
   b. The immediate dive into the core subject will engage readers swiftly, keeping them invested in the unfolding narrative.
2. Background authenticity
   a. The illustrations should genuinely represent the Indonesian setting, emphasizing recognizable architectural and environmental features of typical Indonesian homes.
   b. This ensures the E-Comic is culturally contextual and resonates with the readership.

3. Speech balloon consistency
   a. Maintain uniformity in the design and type of speech balloons to prevent visual clutter and confusion.
   b. Arrange speech balloons hierarchically to make it clear who speaks first in a conversation. This linear flow ensures readers can effortlessly follow dialogues between characters.
   c. The design of the speech balloon should align with the intonation and situation, making it evident if a character is shouting, whispering, or making an aside remark.

4. Visual emphasis
   The e-comic should balance visual illustrations and character dialogues. Instead of relying on characters to explain scenarios, use detailed visual representations. For instance:
   a. Showcase the phenomenon of "wedges gamble" (pyroclastic flows) through a vivid illustration, perhaps juxtaposed with a smaller scene of a character elucidating the event.
   b. Similarly, the process of a volcanic eruption can be presented with a dynamic visual, reducing the need for long explanatory dialogues.

5. Character narration
   a. While characters play a crucial role in progressing the narrative, balancing character dialogues and direct visual storytelling is essential.
   b. Characters can be used to provide context, insights, or emotional perspectives, but over-relying on them for explanatory purposes might saturate the narrative.

![Figure 5. Background E-Comics before and after revision](image-url)
Given the consolidated high ratings across these categories, the E-Comic's overall validation stands at an impressive 97%, earning it the "very suitable" accolade. The strength of these results suggests no immediate need for revisions in the second phase.

The implementation process was carried out after the E-Comic medium was declared valid and suitable for use in learning. Feedback was solicited from the student and teacher through questionnaires, and the results were shown on Table 5 from the teacher and Table 6 from students.
Table 5. Feasibility test results from the teacher

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Score</th>
<th>Percentage</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material appropriateness</td>
<td>22</td>
<td>92%</td>
<td>Very suitable</td>
</tr>
<tr>
<td>Practically display and user effect</td>
<td>20</td>
<td>100%</td>
<td>Very suitable</td>
</tr>
<tr>
<td>Learning media appropriateness</td>
<td>15</td>
<td>94%</td>
<td>Very suitable</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>19</strong></td>
<td><strong>95%</strong></td>
<td><strong>Very suitable</strong></td>
</tr>
</tbody>
</table>

Source: Research data, 2023

Table 5. Feasibility test results from students

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Score</th>
<th>Percentage</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media attractiveness</td>
<td>461</td>
<td>90%</td>
<td>Very suitable</td>
</tr>
<tr>
<td>Media appropriateness</td>
<td>320</td>
<td>83%</td>
<td>Suitable</td>
</tr>
<tr>
<td>Material appropriateness</td>
<td>340</td>
<td>89%</td>
<td>Suitable</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>374</strong></td>
<td><strong>87%</strong></td>
<td><strong>Suitable</strong></td>
</tr>
</tbody>
</table>

Source: Research data, 2023

Overall, the E-Comic achieved an average rating of 87%, categorizing it as “Suitable.” Feedback from the students indicated that the E-Comic was easily accessible, had an engaging storyline, and used language that was easy to understand. They expressed their appreciation for introducing such a medium in their learning process, which they found enriching and innovative.

**CONCLUSION**

In geographical education, developing E-Comics rooted in a contextual framework concerning volcanic eruption mitigation offers promising avenues. This study underscores the creation of such E-Comics employing a Research and Development (R&D) methodology, specifically the ADDIE model. The developmental process encompassed four critical stages: Analysis, Design, Development, and Implementation. An in-depth curriculum analysis coupled with an understanding of student characteristics was pivotal in determining the type of media to be designed. Subsequently, the conceptualization phase entailed the creation of a storyboard, which laid the foundation for the design and graphical refinement using the software ibisPaint X.

Upon completion, the E-Comic underwent rigorous validation by media and subject matter experts to ascertain its appropriateness in content and delivery. The media experts' validation, revised twice, yielded a score of 52 out of a potential 60, translating to an 87% approval rate, thereby categorizing the E-Comic as “Suitable” for integration into geographical education. Concurrently, the material expert's evaluation, which required no revisions, presented a score of 58 out of 60, indicating a 97% endorsement rate and categorizing it as "Highly Suitable." Additionally, preliminary tests on students reflected an 88% satisfaction rate, and the geographical educators' assessment recorded an 87% approval, both falling under the "Suitable" category.

The E-Comic, currently hosted on the Webtoon platform, boasts a distinct advantage: readers can download the content for offline access. However, this innovation is not without its challenges. For instance, initial access requires an internet connection, and the platform does not support animated graphics. For future researchers venturing into this domain, it is recommended that they enhance and refine the E-Comic modules developed in this study. While the current content broadly addresses the mitigation of volcanic eruptions, there is a
discernible need for a more comprehensive exploration. Thus, subsequent researchers are encouraged to delve deeper into the subject matter, possibly extending to other disaster mitigation topics, ensuring alignment with real-world scenarios or specific issues pertinent to the intended study locale, all underpinned by a contextual approach.

REFERENCES


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