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Development of Android-based Comic Learning Media for Grade VII Science Subject in Junior High School

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Abstract: This developmental study aims to create an Android-based comic learning media for Grade VII students, focusing on Earth and Solar System material in science subjects. The objective is to enhance learning experiences and assess the media's feasibility. Existing learning resources often fail to meet students' needs and improve learning outcomes. Following the ADDIE model, the research includes analysis, design, development, implementation, and evaluation stages. Thirty Grade VII students from SMPN 1 Harau District participated in the study for the academic year 2023/2024. Research instruments included validation sheets, teacher and student questionnaires, and test items. The Android-based comic media was validated by experts in media, material, and language, scoring very valid in all aspects. Teacher and student feedback rated the media as very practical. In the effectiveness test, students achieved an average posttest score of 82.08, with an achievement percentage of 83.33%. The average gain test result was 0.63, indicating moderate improvement. This study demonstrates the validity, practicality, and effectiveness of Android-based comic learning media in teaching Earth and Solar System material to Grade VII students.

Keywords: ADDIE development model; Comic; Development; Science subject

Introduction

The learning process involves a dynamic relationship between students, teachers, and learning materials within an educational environment (Abdulrahaman et al., 2020; Kerimbayev et al., 2023; Lodge et al., 2018). The primary goal of learning is to help students acquire knowledge, develop skills, and form positive attitudes. According to Permendikbudristek No 16 of 2022, the standard learning process should involve active student participation, create motivation, and provide enjoyable experiences. The role of the teacher is crucial in designing effective learning (Darling-Hammond et al., 2020). Teachers must create high-quality and enjoyable learning experiences to achieve educational goals (Khairiyah et al., 2024; Murray, 2021). The learning environment needs to be well-organized, including analyzing students' needs, understanding their individual characteristics, and selecting appropriate materials and strategies (Haleem et al., 2022; Kintu et al., 2017; Roldán et al., 2021). Learning media play a key role in this process. The appropriate use of learning media can enhance student participation and make learning more engaging (Ratnasari et al., 2019; Sivakumar et al., 2023).

Effective learning media should be able to simplify information and capture students' attention (Gore et al., 2024; Graham et al., 2020, 2022). Currently, technology and digital media have great potential to support the learning process. Teachers need to choose technology and media that suit students' needs to improve their understanding and engagement in learning (Balalle, 2024). However, observations at UPTD SMP Negeri 1 Harau District indicate that the learning process is still teacher-centered, with the learning media used not fully effective. Students often feel bored and unfocused, while the utilization of technology remains limited (Balalle,

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2024). This highlights the need for innovation in using more engaging and interactive learning media.

Using android-based comic media can be a solution to increase students' interest and understanding (Bergdahl, 2022; Utami et al., 2023). Comics presented in a mobile application format allow easy and flexible access for students (Dhawan, 2020). These comics combine visual elements with engaging narratives, which can motivate students to learn and understand the material better (Pazaer et al., 2023). The development of android-based comic media aims to create a more effective, engaging, and enjoyable learning experience (Fitria et al., 2023). By leveraging available technology, such as the tablets at UPTD SMP Negeri 1 Harau District, it is hoped that the learning process can be enhanced. The author strives to develop android-based comic learning media for Grade VII science subjects as an effort to improve the quality of education.

Method

The development model used in this research is the ADDIE model. The ADDIE model consists of five steps: analysis, design, development, implementation, and evaluation. The ADDIE model was developed by Dick and Carey for designing learning systems. Stages of the ADDIE model in the development of Android-based comic learning media. (Analysis) there are three segments that need to be analyzed: students, learning, and the media used to deliver the teaching material. (Design) this activity is a systematic process that begins with setting learning objectives, designing scenarios or teaching and learning activities, designing instructional tools, designing learning materials, and evaluating learning outcomes.

Development in the ADDIE model involves the realization of the designed product. In the development stage, the conceptual framework is transformed into a product ready for implementation. Implementation). Implementation is the tangible step to apply the learning system being created. This means that, in this stage, everything developed is installed or configured according to its role or function for implementation. (Evaluation). Evaluation is the process of assessing whether the learning media being developed has been successful according to the initial expectations or not. Evaluation is a process conducted to provide a rating for the learning media. The flowchart of the development of Android-based comic learning media in this study can be seen in the figure 1.

The research was conducted at SMPN 1 Harau District, located on Negara Street, KM 7, Tanjung Pati, Kenagarian Koto Tuo, Harau District, Lima Puluh Kota Regency, West Sumatra Province. The research subjects were seventh-grade students. The type of data is primary data, which is directly obtained through validation questionnaires, practicality questionnaires, and student learning outcomes to assess effectiveness using exercise questions. After the required data is collected, the next step is data analysis. This is intended to interpret the data obtained from the research results. Research data is analyzed using descriptive statistical analysis. Descriptive statistics can take the form of bar charts, pie charts, mode, median, mean, and size variability. Using descriptive analysis, research data can be analyzed as follows:

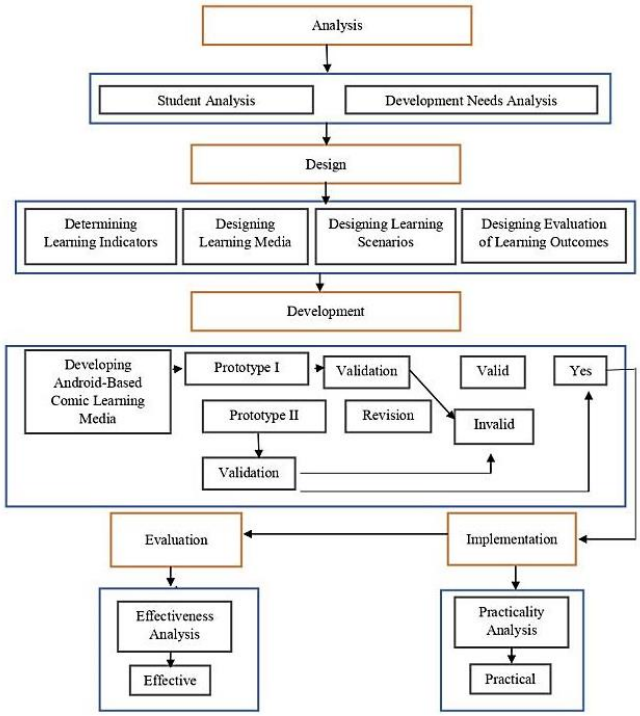

Figure 1. Flowchart of the development of android-based comic learning media

Analysis of Validity Questionnaires

The validity analysis was conducted on the validity of media, content, and language data. Validity data were obtained using a Likert scale from validators regarding all assessed aspects, presented in the form of a table as shown in Table III.2. Subsequently, the validation results were analyzed on a scale of 0 to 100 using the formula (Riley et al., 2024).

$$\text{The validity of comic media} = \frac{Total\ empiral\ score}{Total\ Maximum\ score}\ x\ 100\ \% \quad (1)$$

Table 1. Validity Category (Riduwan, 2013)

Validity Score (%)	Category
81-100	Very valid
61-80	Valid
41-60	Fairly Valid
21-40	Invalid
0-20	Very Invalid

Analysis of Media Practicality

The category of practicality for Android-based comic media is obtained from the analysis of questionnaires regarding the responses of teachers and students using a Likert scale. The questionnaire on the practicality of using Android-based comic learning media for seventh-grade science subjects by teachers and students is assessed from several aspects. The practicality questionnaire is described using a frequency data analysis technique using the formula according to (McNeish et al., 2020) as follows:

$$media\ practicality = \frac{Total\ empiral\ score}{Total\ Maximum\ score}\ x\ 100\ \% \quad (2)$$

The instrument validity categories based on the final scores are then presented on a scale of 0 - 100 in Table 2 as follows:

Table 2. Practicality Category (Asfar et al., 2023)

Validity Score (%)	Category
81-100	Very Practice
61-80	Practice
41-60	Fairly Practice
21-40	Inpractice
0-20	Very Inpractice

Analysis of the Effectiveness of Android-Based Comic Media Data

To analyze the data obtained from the research results, descriptive and inferential statistical analysis will be used. The collected data consists of pretest and posttest scores, which will then be compared. Comparing these two scores raises the question of whether there is a difference between the pretest and posttest scores. The effectiveness of the developed learning media is analyzed through the measurement data of students' learning outcomes. Students are considered successful if they achieve a score greater than or equal to the passing grade. Classical learning success is achieved if at least 75% of students attain passing grades. The determination of students' learning outcomes based on the scores obtained is calculated using the formula:

$$Score = \frac{total\ correct\ score}{maximum\ score}\ x\ 100\% \quad (2)$$

The collected data is analyzed using descriptive quantitative analysis to describe the mastery of students' learning outcomes after using the developed learning media.

Result and Discussion

This study is a Research and Development (R&D) aimed at producing Android-based comic learning media capable of facilitating 7th-grade Science class activities on the Earth and Solar System topics. The study also aims to test the feasibility and practicality of the media, as well as measure the effectiveness of the media in supporting students' learning success. This research is intended for Junior High School (SMP) students and follows the ADDIE model, consisting of the following steps:

Analysis Stage (Analyze)

Analysis is the fundamental stage in conducting Research and Development (R&D) using the ADDIE model. The analysis is carried out with the aim of identifying various elements that can accommodate the needs of students. The analysis is necessary to gain an understanding of media development. In this stage, it is essential to identify existing problems, the needs of students, and consider constraints such as the environment, time, and cost (Coman et al., 2020). Analysis is conducted to obtain an overview of the initial conditions of students, teachers, media, and the curriculum used (Montenegro-Rueda et al., 2023). The researcher analyzes the needs, curriculum and material, and the 7th-grade SMP students.

Design Stage (Design)

The design stage is known as the phase of creating product designs or printing. The purpose of the design stage is to determine how the media will be designed comprehensively according to the core material, and then formulate the learning objectives that will be designed into the media. The developed media is adjusted to the learning achievements of the independent curriculum on the Earth and Solar System topics for 7th-grade SMP.

The learning media is created using full-color Indonesian language with a comic canvas size of 800 x 1280 px. The resulting product uses the Pixton application in flipbook format. The arrangement of the Android-based comic learning media for Earth and the Solar System in the independent curriculum includes a cover, learning achievements, learning objectives, material, and is finally complemented with quizzes in each meeting using the Quiziz application. The media development design involves preparing the necessary materials for media development, such as learning achievement guidelines, the textbooks used by students, conducting a literature review of the material and media developed, designing backgrounds and characters, sketching, and packaging the comic media (Keiler, 2018).

Figure 2. Comic image

Development Stage (Develop)

The development stage is the phase of the product creation process and quality refinement. The goal of the development stage is to produce a learning media that is suitable after revision based on input from experts (Armen et al., 2019; Hardiansyah et al., 2023). The result of developing Android-based comic media on Earth and Solar System material for 7th-grade students, designed using the Pixton application and packaged in a flipbook. The Android-based comic media produced is in the form of apk, html, and barcode formats that can be accessed both online and offline.

The product was successfully developed and subsequently underwent media feasibility testing through product validation (Cappell et al., 2023). Design or product validation is carried out after the initial product is created. Validation is done in three ways: design validation by media experts, content validation by subject matter experts, and language quality validation by language experts (Hidayat et al., 2020; Luque-Vara et al., 2020; Seo et al., 2015). Based on the results of expert validation in terms of media, content, and language, the recapitulation of the validation results of Android-based comic media can be summarized in the following table.

Table 3. Recapitulation of Media Validation No Aspect Percentage Category

Aspect	Percentage	Category
Media	84	Very Valid
Content	90	Very Valid
Language	92	Very Valid

The validation results for Android-based comic media on the media aspect are 84%, categorized as very valid. The media aspect is a criterion or basis for assessing Android-based comic media in terms of its suitability for the developed media. The validation results for Android-based comic media on the content aspect are 90%, categorized as very valid. The content aspect is a criterion or basis for assessing Android-based comic media in terms of the suitability of the material included in the media for the theory of Earth and the Solar System. The material in Android-based comic media is considered very valid.

The validation results for Android-based comic media on the language aspect are 92%, categorized as very valid. The language aspect is a criterion or basis for assessing Android-based comic media in terms of the suitability of language usage in conveying comic content. The language in Android-based comic media is considered very valid. Based on the validity categories, the validation results of Android-based comic media on the Earth and Solar System material fall into the very valid category. According to expert validation, the highest validation score was obtained in the language aspect, reaching 92%, categorized as very valid. Referring to the validity category, the validation results of Android-based comic media on the Earth and Solar.

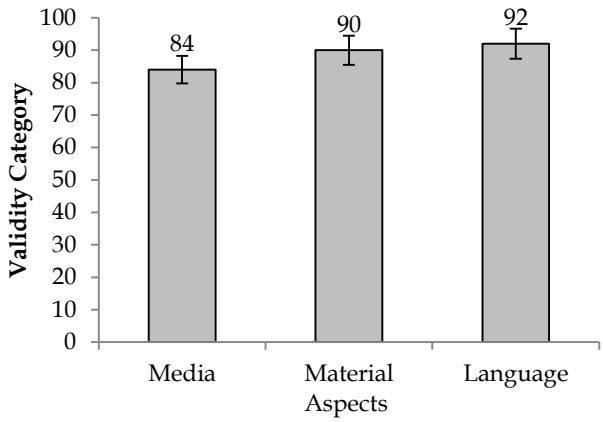

Figure 3. Validation of android-based comic media

System material are included in the very valid category. Based on the validation tests by experts, the highest validation score was obtained in the language aspect, reaching 92%, categorized as very valid.

Implementation Stage (Implementation)

The implementation phase of the Android-based comic media development for the 7th-grade Science subject on Earth and the Solar System was conducted in three meetings, spanning two weeks of research. The implementation took place in one class. The process began by administering a pretest in the first meeting, followed by the actual learning activities. In the final meeting, an evaluation test in the form of a posttest was conducted, along with the measurement of the practicality level of the media by both the teacher and the students (Amnie et al., 2021).

After conducting the learning inside the classroom, teachers and students were asked to perform a practicality test. The practicality test by the teacher was carried out on two Science teachers from UPTD SMPN 1 Harau District by providing a practicality questionnaire. Based on the results of the practicality test by the teacher, the practicality data of Android-based comic media in the 7th-grade Science subject on Earth and the Solar System obtained a result of 90%, categorized as highly practical. The practicality test for students was conducted on all 30 students of class VII.A. Based on the results of the practicality test by the students, the data for the practicality test of Android-based comic media in the 7th-grade Science subject on Earth and the Solar System obtained a result of 91%, categorized as highly practical.

Based on the results of the practicality test conducted by both teachers and students, the recapitulation of the practicality test results of Android-based comic media in the 7th-grade Science subject on Earth and the Solar System can be summarized as follows:

Table 4. Recapitulation of Practicality Test Results

Indicator	Percentage (%)	Category
Teacher	90	Highly Practical
Student	91	Highly Practical

Referring to the practicality category, the practicality results for both students and teachers fall into the highly practical category. The practicality results of Android-based comic media can be seen in the diagram figure 4.

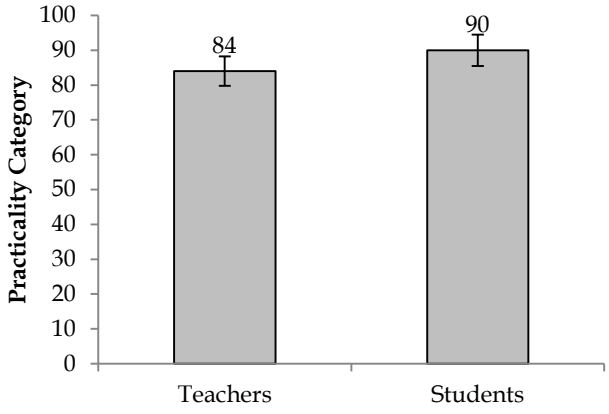

Figure 4. Practicality test of respondents

Evaluation Stage (Evaluation)

Evaluation in this research includes formative and summative evaluations (Mubayrik, 2020; Onasanya et al., 2024). Formative evaluation involves collecting data at each stage used to refine the product, which is the Android-based comic media for the science subject of grade VII, covering the Earth and Solar System. Summative evaluation is conducted at the end of the research to examine the impact of the Android-based comic learning media on the science subject for grade VII students at SMPN 1 Harau District.

Based on the pretest and posttest data analyzed from students, it can be concluded that there is an average difference in learning outcomes before and after the test, as reflected in this table.

Table 5. Recapitulation of Student Pretest and Posttest

Result Learning	Average
Pretest	55.87
Posttest	82.27

The average learning outcomes observed from the pretest indicate a score of 55.50, while the average posttest score reaches 82.08. Figure 5 shows the comparison between the higher posttest scores compared to the pretest scores.

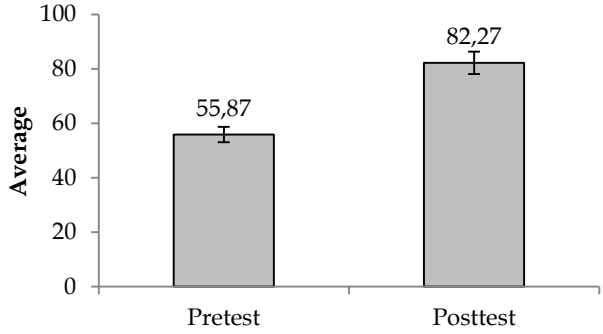

Figure 5. Student learning outcomes

Student learning outcomes were measured through the application of the Gain Test analysis method, which aims to assess the improvement in student understanding by analyzing pretest and posttest scores (Siagian et al., 2023). Based on the Gain test, student learning outcomes were obtained with 11 students in the high category, 19 students in the medium category, and no students in the low category. The Gain test result for student learning outcomes was 0.63, categorized as moderately effective. The Gain test data proves that there is a difference in Gain scores between posttest and pretest student learning outcomes using Android-based comic media (Damayanti et al., 2020; Listianingsih et al., 2021; Mahfudoh et al., 2024; Ramadanti et al., 2023).

Conclusion

This developmental study aims to create an Android-based comic learning media for Grade VII students, focusing on Earth and Solar System material in science subjects. The objective is to enhance learning

experiences and assess the media's feasibility. Existing learning resources often fail to meet students' needs and improve learning outcomes. Following the ADDIE model, the research includes analysis, design, development, implementation, and evaluation stages. Thirty Grade VII students from SMPN 1 Harau District participated in the study for the academic year 2023/2024. Research instruments included validation sheets, teacher and student questionnaires, and test items. The Android-based comic media was validated by experts in media, material, and language, scoring very valid in all aspects. Teacher and student feedback rated the media as very practical. In the effectiveness test, students achieved an average posttest score of 82.08, with an achievement percentage of 83.33%. The average gain test result was 0.63, indicating moderate improvement. This study demonstrates the validity, practicality, and effectiveness of Android-based comic learning media in teaching Earth and Solar System material to Grade VII students.

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Author Contributions
The contributing authors include W. N., F. Y. J., as the supervisor, J., R. H. as the examiner. Additionally, W. N., F. Y. J served as validators.

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Conflicts of Interest
The authors declare no conflict of interest.

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