Development of G-Sites-Based Character Education Media Assisted by Augmented Reality with the PBL Model in Elementary Schools

Tri Sari Yanti[1*], Makmum Raharjo[1], Syarifuddin[1]

[1]Department of Educational Technology, Faculty of Teacher Training and Education, Postgraduate, Universitas Sriwijaya, Palembang, Indonesia.

Abstract: This study aims to produce a valid, practical, and effective G-sites-based character education learning media assisted by Augmented Reality with the PBL model in Elementary Schools for student learning outcomes. This study was conducted in grade V of SDN 3 Sukamaju, with 46 students as research subjects. The type of research used is Research Development (RD) with the ADDIE development model and Tessmer Evaluation. Data were collected through interviews, observations, expert reviews, one to one, small groups, and pretest-posttest. The results showed that the average validity by media experts was 85%, validity by material experts was 86%, and validity by language experts was 91% with a very valid category, the practicality score at the one to one stage was 80.66% with a very practical category, and the small group results obtained were 85% including the very practical category. Furthermore, the effectiveness of G-sites-based learning media assisted by Augmented Reality can be seen from the learning outcomes of students measured through field trials in pretest activities of 50.69% and posttest with an average value of 84.56% and N-Gain of 0.77 which is included in the high category. It can be concluded that G-Sites-based learning media assisted by Augmented Reality is proven to be valid, practical, effective and very suitable for use in instilling character education in grade V Elementary School students.

Keywords: Augmented reality; Character education; Elementary school; G-sites; PBL

Introduction

In today's digital era, technology is a key source of knowledge and reference in the learning process. Therefore, technology is integrated into education with the aim of promoting more diverse learning (Navas-Bonilla et al., 2025; Markey et al., 2023). This transformation has also changed the way classrooms look and operate. Modern classrooms are equipped with various digital tools and resources that facilitate learning and increase student engagement (Subroto et al., 2023; Masruddin et al., 2024). This advancement has also had a significant impact on the world of education, which now utilizes information technology, simplifying educational activities, from academic administration to teaching and learning. One indicator of this is the abundance of information technology-based learning media, ranging from presentation applications to e-learning or web-based learning media, among others. One trending website is Google Sites (G-Sites). This aligns with research (Wang et al., 2022; Kurniawan et al., 2024), that G-Sites have significant potential as learning media both inside and outside the classroom with the support of an internet connection. Research related to G-site-based learning media has also been conducted by Kolhar et al. (2021). G-site learning media is very

attractive to use because it is easily accessible, attracts students' interest in learning, facilitates comprehension of the material, and uses language that is easy to understand and appropriate to students' thinking levels.

Using G-site in learning can add materials to be studied and can be downloaded by students as teaching materials. Furthermore, users can combine various features to support the learning process. One purpose of using features is to provide conditions that resemble reality, thereby reducing ambiguous and abstract perceptions (Ohashi et al., 2025). Based on research by Hendajani et al. (2018) and Flores-Bascuñana et al. (2019), Augmented Reality (AR) is an animation-based application that can move and has a realistic or 3D shape. This animation can be used by both students and educators. Meanwhile, according to Suprapto et al. (2021) and Chamusca et al. (2025), AR is a technology capable of combining 2D and 3D virtual objects into a real 3D environment, then projecting these virtual objects in real time. According to Chen et al. (2019) and Koumpouros (2024), in their research on the Development of Android-based learning media using AR for flat-sided geometric shapes, AR technology is a visual technology that combines virtual world objects into real-world displays in real time (Syed et al., 2022).

Character education is a continuous and never-ending process, resulting in continuous quality improvement aimed at developing future human beings and rooted in the nation's cultural values (Syapal & Amin (2022) and Rangkuti et al. (2022). Character education is a habituation initiated from an early age that will foster a strong national character and ultimately become a key factor in national development (Ma'rufah, 2022). Science learning is one of the subjects that can be utilized to teach environmentally conscious character education. Science learning can help students understand basic environmental principles and help them realize the importance of preserving the environment (Hasibuan & Sapri, 2023). Character education in science learning instills social values such as responsibility, courtesy, mutual respect, mutual assistance, and mutual cooperation (Abustang et al., 2023). This research is based on observations at SDN 3 Sukamaju that revealed low student awareness of maintaining school cleanliness. Therefore, the researchers intend to conduct research and develop G-Sites-based character education media supported by Augmented Reality using the PBL model in elementary schools.

Method

This research used the R&D (Research and Development) method with the ADDIE development model and Tessmer evaluation. The ADDIE development model consists of several stages: analysis, design, development, implementation, and evaluation. Tessmer evaluation was conducted during the implementation and evaluation stages.

Table 1. Validation scores from media experts, material experts, and language experts

Alternative Answers	Score
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

Table 2. Criteria for the suitability of media, materials and language

Percentage score (%)	Eligibility Criteria
81–100	Very Eligible
61–80	Eligible
40–60	Quite Eligible
21–40	Less Eligible
0–20	Very Less Eligible

Validity testing is a step to measure the accuracy of an instrument in research. This aligns with Marar et al. (2023), opinion that validity testing is a step to examine data from an instrument to measure the accuracy of the instrument used in research. Test data processing is carried out by comparing student learning outcomes during the initial test with the results of the final test. To see the improvement and comparison of average scores, the N-Gain score is used. To obtain the N-Gain score, the following formula is used:

$$N_{gain} = \frac{S_{posttest} - S_{pretest}}{S_{maximum} - S_{pretest}} \qquad (1)$$

Table 3. N-Gain level criteria

N-Gain Score	Criteria
g ≥ 0.70	High
0.70 > g ≥ 0.30	Medium
g < 0.30	Low

Results and Discussion

Based on the results of research conducted at Sukamaju 3 Public Elementary School, researchers developed G-Sites-based character education learning media supported by Augmented Reality using the PBL model in elementary schools. The results of the questionnaire distributed by the researchers at the beginning of the study, namely the teacher and student needs analysis questionnaire, are the most important considerations in selecting learning media (Marpanaji et al., 2018; Nurasiah et al., 2022). Suggestions and input

from the supervising lecturer, media experts, material experts, and language experts were very helpful in producing G-Sites-based AR-assisted character education learning media. According to Nasution & Astuti (2024), Criollo-C et al. (2021), and Purnama et al., 2024), G-Sites is an easy-to-use learning application that only requires a mobile phone and internet access (Oliveira et al., 2021; Ürek, 2024); no downloads are required; students or teachers can access it through Google.

Meanwhile, Augmented Reality (AR) is a medium that combines images, video, audio, and text into a realistic environment (Alzahrani, 2020; Sari et al., 2023). This means that students can experience what they see through AR media as if they were experiencing it (Prasetya et al., 2024; Chang et al., 2022). The use of the PBL model in the development of AR-assisted G-Sites media is to include each stage in the PBL model into the G-Sites application so that students can carry out learning activities together in one application (Nawwal & Setyasto, 2025; Marini et al., 2025). The following is a display of G-Sites-based character education media assisted by Augmented Reality with the PBL Model in elementary school.

Figure 1. G-Sites home page view

Figure 2. G-Sites menu display

After the product was developed, validation was conducted by media experts, content experts, and language experts. Three aspects were assessed for media validation: symbol system, technological perspective, and processing capability (Verboord, 2022; Masrianto et al., 2022). Similarly, four aspects were assessed by content experts: curriculum, learning model characteristics, materials, and evaluation. Finally, validation by language experts also assessed four aspects: word spelling, paragraph writing, spacing, and letter spelling.

Table 4. Summary of validation results

Expert Validation Results	Score (%)	Criteria
Media	85	Very Valid
Material	86	Very Valid
Language	91	Very Valid

The summary of the assessment results based on validation by media, material, and language experts shows that the overall percentage by media experts for the three assessed aspects was 85%, with the criteria being very valid. Similarly, the results of validation by material experts for the four assessed aspects were 86%, with the criteria being very valid. Finally, the language experts obtained a percentage of 91% based on the four assessed aspects. It can be concluded that the AR-assisted G-Sites-based character education media can be used for research because it meets the feasibility score (Nurhikmah et al., 2024; Major et al., 2021). Furthermore, one-on-one trials will be conducted with three students to test the practicality of the learning media.

Table 5. Summary of media practicality

| Validation Results	Average %	Criteria
Teacher Responses	90.50	Very Practical
One-to-One Test	80.66	Very Practical
Small Group Test	84.11	Very Practical

Based on the results of teacher and student responses intended to determine the practicality of the developed media, the teacher trial resulted in a 90.5% score, while the one-to-one test resulted in 80.66% score, and the small group test resulted in 84.11% score. These results indicate that the developed media and materials are categorized as very practical, according to the criteria established by Yulihendri & Evanita (2023) and Febriati et al. (2022). After conducting practicality trials with students and teachers, the next step was to assess the effectiveness of the developed learning media through a field test. This effectiveness can be measured by assessing learning completion through pretests and posttests. Based on the results of the pretest and posttest in the field test, the average scores were 50.69% for the

pretest and 84.56% for the posttest, categorizing them as very effective.

Table 6. Summary of media effectiveness

	Percentage (%)	N-Gain	Category
Pretest	55.65	0.77	Very Practical
Posttest	83.59		

Based on Table 6, the pretest result was 55.65%. This result was obtained before the media was used. And after the media was tested on students, a change in student learning outcomes was obtained, namely 83.59%. With an N-Gain score of 0.77 obtained and the category is very practical. The following is a picture of the pretest and posttest results after and before using the media.
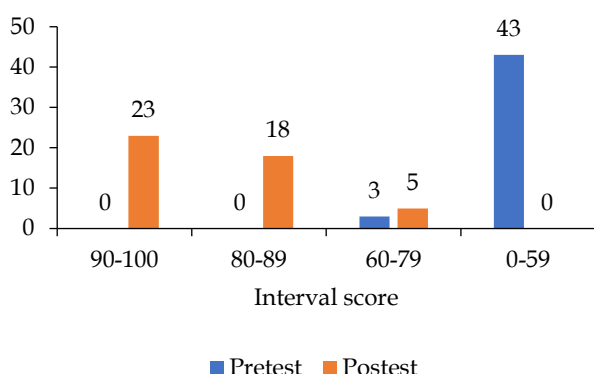
Figure 3. Comparison of Students Pretest and Posttest Graph

Conclusion

This research aims to design and develop G-Sites-based character education media with Augmented Reality (PBL) models in elementary schools. This G-Sites-based Augmented Reality-based character education media has undergone validation by media experts, material experts, and language experts. The media expert validation results were 85%, the material expert validation results were 86%, and the language expert validation results were 91%, categorized as very valid. Based on the results of a limited trial using a questionnaire completed by students and teachers, the G-Sites-based Augmented Reality-based character education media was found to be very practical, with 90.50% teacher responses, 80.66% student one-on-one responses, and 84.11% small group responses. This indicates that the media is considered practical and suitable for use in the learning process, and is well-received. Student learning outcomes also improved. The pretest achieved a percentage of 55.65% and a posttest score of 83.59%, with an N-Gain score of 0.77, categorized as very practical.

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