Mathematics Learning through Differentiated Student Worksheet based on Assemblr Edu

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Article Info	ABSTRACT
	This study aims to develop differentiated student worksheet of learning media based on Assemblr Edu. Through the development of differentiated and innovative learning media, it can meet the diverse learning needs of students by considering the readiness, interests, and talents of students. The development model used is Dick and Carrey. The subjects of this study were fifth-grade students of SDN 1 Srirahayu, Pringsewu Regency, Lampung in the mathematics subject of cubes and cuboids. The results of the validation of material experts were 89.24% and media experts 91.21%, meaning that student worksheet based on Assemblr Edu is suitable for use as a trial. The trial went through the stages of small group trials, medium groups, and large groups. The results of the trial received a good response, with an average of 88%. The implications of the development carried out are an increase in understanding of the concept of cubes and cuboids, learning that is more interesting and innovative, more effective learning differentiation and the creation of learning independence.

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INTRODUCTION

Differentiated learning approaches allow teachers and students to be actively involved in learning according to students' needs, interests, and learning styles (Ilmiah Pedagogy et al., n.d.). Where, the differentiation approach is very relevant to the context of mathematics learning because it can accommodate students' learning needs that are adjusted to their interests, learning styles, profiles, and learning readiness (Gusteti & Neviyarni, 2022). Mathematics is considered a difficult subject and requires a fairly deep understanding (Febrianti et al., n.d.). Therefore, differentiated mathematics learning requires interesting, interactive, and easy-to-use media and learning resources.

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students' learning needs that are adjusted to their interests, learning styles, profiles, and learning readiness (Gusteti & Neviyarni, 2022). Mathematics is considered a difficult subject and requires a fairly deep understanding. Therefore, differentiated mathematics learning requires interesting, interactive, and easy-to-use media and learning resources.(Ariani Finda Yuniarti et al., n.d.; Sucipto & Mauliddin, 2017; Veni Rahayu & Aldila Afriansyah, 2015)

The development of innovative learning media such as technology-based Student Worksheets (LKPD) is very important. The traditional approach to learning that tends to be monotonous and less interactive is one of the factors in the lack of interest in learning mathematics. Students of UPT SD Srirahayu Kec. Banyumas still have difficulty unders tanding mathematical concepts because the learning media used are in the form of printed books or teaching modules in printed form. The learning media most often used is the blackboard, while other learning media such as PPT and learning videos are rarely used (Efendi & Muhammadi, 2023). The use of printed textbooks or teaching modules is not said to be sufficient in facilitating learning. (Hardiansyah et al., 2023)Moreover, the Implementation of the Independent Curriculum still makes it difficult for teachers to facilitate the learning media that will be used. If we look at the Education report card, numeracy skills are still yellow, which means that students are still constrained by their understanding or critical thinking skills in mathematics learning. Numeracy skills are the abilities and skills possessed by students so that students can or can apply, apply the concepts of numbers and arithmetic operations in everyday life. Even though numeracy is not only in mathematics lessons, numeration is part of mathematics which is taken from mathematical content (Fauziah Hazimah & Sutisna, 2023).

As a result, interesting learning innovations are needed that can increase student engagement, facilitate a deeper understanding of concepts, and support a more interactive learning process in learning, especially mathematics learning in elementary schools. The use of Augmented Reality-based LKPD helps students improve their critical thinking skills (Kurnia Sari et al., n.d.)

Through learning platforms such as Assemblr Edu, teachers can design LKPDs that are not only interesting but also adaptive to students' needs (Kurnia Sari et al., n.d.; Triana et al., n.d.)Assemblr Edu is a learning media in the form of 3-dimensional applications and Augmented Reality (AR) that are interactive and fun (Chairudin et al., 2023). Some interesting features of Assemblr Edu can integrate various media such as animated videos and interactive quizzes that can clarify students' understanding of the mathematics material included in the LKPD. Assemblr edu can be accessed via an application or web browser and can be used both inside and outside the classroom. Teachers can connect a PC/laptop to an LCD projector in the classroom, to demonstrate to students. Through this platform, collaboration between students can be created that allows them to discuss completing assignments and create an inclusive learning atmosphere that is responsive to individual differences so that an interesting learning experience is created.

The development of Assemblr Edu-based LKPD for differentiated, technology-based mathematics learning shows great potential in improving mathematics learning outcomes in elementary schools. Assemblr Edu not only acts as a visual aid but also provides an immersive and contextual learning experience. The use of Augmented Reality (AR)-based applications in learning has been proven effective in increasing learning motivation and understanding of abstract concepts.(Chairudin et al., 2023). Through this approach, teachers are expected to be able to provide materials that are appropriate to the needs of each student, so that they can learn effectively according to the needs of each student. In addition, Assembley Edu in LKPD makes students' learning experiences more interesting and reduces the negative stigma inherent in mathematics learning.

METHOD

This research is a development research (Research and Development) using the Dick and Carey model which consists of ten stages, namely Identify Instructional Goals, Conduct Instructional Analysis, Analyze, Learners and Contexts, Write Performance Objectives, Develop Assessment Instrument, Develop instructional strategy, Develop and select instructional materials, Design and conduct formative evaluation of instruction, Revise instruction, Design and conduct summative evaluation (Walter Dick et al., 2015)
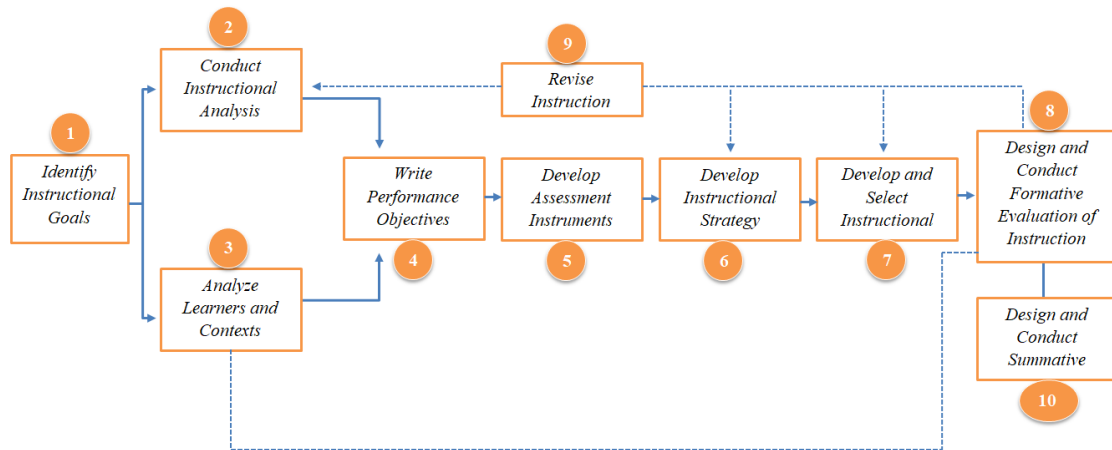
Picture 1. Dick and Carey Chart Model

The Dick and Carey model was chosen because the Dick and Carey model describes the development steps in more detail than other development models and is systematically structured to create a product or learning program. In addition, there is an interrelated relationship between each component, especially the relationship between learning strategies and desired learning outcomes (Setyawan & El Hakim, 2023).Product trials were carried out in three stages, namely small groups of 1-5 students, medium groups of 15 students, and large group trials of 25 students at the UPT SD Srirahayu, Pringsewu Regency.

The subjects of this study were 17 students of grade V SDN Srirahayu, Pringsewu Regency. The material used in this study was the cube and cuboid geometry in the odd semester load of 2024. Differentiated LKPD based on Augmented Reality was developed using the Canva application which was inserted with a QR code from the Assemblr edu application. In addition, this LKPD is also accompanied by a QR code for the Gennialy game and a YouTube video containing questions and explanations of learning materials that are adjusted to students' learning styles. Through smartphones, students are directed to access the QR-Code using the EDU Assemblr application in solving the questions in the LKPD that facilitate students' learning styles. The data collection techniques used in this development research were in the form of interviews and questionnaires. The test instrument was in the form of media expert validation sheets, material experts, and student responses. Meanwhile, the instruments in this research were as follows: (1) interviews to analyze problems, and student needs in supporting the learning process, (2) product and media validation sheets to test the feasibility of the products and materials developed, (3) teacher response questionnaires as users of the media to be developed, (4) student response questionnaires, and (5) analysis of learning outcomes to determine the level of effectiveness of using LKPD through pretest and posttest results.

RESULTS

The results of this study are in the form of differentiated LKPD products based on Asembler-EDU in supporting mathematics learning. The development of differentiated LKPD based on Assemblr-Edu uses the Dick and Carey model with ten stages of development as follows:

1. Identify Instructional Goals

    The results were obtained through interviews conducted with teachers at UPT SDN Srirahayu. The interview sample consisted of primary school teachers involved in the implementation of the independent curriculum. To analyze the interview data, the researcher first transcribed the recorded interviews. Next, responses were categorized based on recurring themes related to curriculum implementation and challenges in differentiated learning. Finally, the categorized data were interpreted to identify key instructional goals. The analysis revealed that while the independent curriculum has been implemented, there is a shortage of books and LKPD (Lembar Kerja Peserta Didik) that align with differentiated learning principles. Additionally, teachers demonstrated limited expertise in developing teaching materials and technology-based LKPD that support student-centered mathematics learning and cater to individual student needs.

2. Conduct Instructional Analysis

    The instructional analysis was conducted by examining the cube and cuboid material that will be taught to students at UPT SDN Srirahayu, aligning it with their learning abilities. The data were obtained through interviews with teachers to understand their perspectives on students' comprehension levels and the challenges they face in teaching this topic. The interview results were analyzed by transcribing responses, identifying common themes, and categorizing the information based on instructional needs. The material is designed to focus on key concepts such as the properties and volume of cubes and cuboids, with an emphasis on visualization using Augmented Reality to enhance students' understanding.

3. Analyze Learners and Contexts

    The instructional analysis was conducted by examining the cube and cuboid material to be taught to students at UPT SDN Srirahayu, ensuring it aligned with their learning abilities. The data were obtained through interviews with teachers who were selected as the interview sample, as they provide insight into students' comprehension levels and the challenges faced in teaching this topic. The interview results were analyzed systematically, starting with transcribing the interviews, followed by identifying common themes related to instructional challenges, and finally categorizing the information based on instructional needs. This analysis helped guide the development of materials focused on key concepts, such as the properties and volume of cubes and cuboids. An emphasis was placed on visualization using Augmented Reality to enhance students' understanding of the material.

4. Write Performance Objectives

    At this stage, performance objectives were formulated based on the analysis of interview results collected from teachers. The interview responses provided insight into students' learning needs and challenges in mastering cube and cuboid geometry concepts. The analysis process involved first transcribing the interview recordings, then categorizing the responses into key themes related to students' comprehension levels and learning difficulties. These themes were further analyzed to identify instructional strategies that could effectively enhance students' understanding. Based on these findings, the performance objectives were formulated to ensure that students can understand the properties and volume of cubes and cuboids through

the use of Augmented Reality. Additionally, the objectives include students' ability to apply this understanding to solve differentiated mathematical problems efficiently.

5. Write Performance Objectives

At this stage, performance objectives include students' ability to understand the concept of cube and cuboid geometry using augmented reality to understand the properties and volume of geometric geometry and to be able to solve differentiated mathematical problems.:

Table 1. Product validation results

Validators	Presentation	Category
Media expert	91,21 %	Very worthy
Material expert	89, 24%	Very worthy

The validation results indicate that the product has been thoroughly reviewed by both media and material experts. The media expert gave a score of 91.21%, categorizing the product as "Very worthy," meaning that the use of Augmented Reality in teaching cube and cuboid geometry is highly appropriate and effective for instructional purposes. Similarly, the material expert provided a score of 89.24%, also classifying the product as "Very worthy," suggesting that the content and instructional strategies are of high quality and suitable for enhancing students' understanding of geometric concepts. These high validation scores confirm that the instructional product is both pedagogically and technologically sound

6. Develop instructional strategy

Strategy development begins by pouring the results of the initial analysis into a teaching module by paying attention to the media and learning models used to achieve learning objectives by utilizing differentiated LKPD with the integration of Asembler-Edu-based technology.

Figure 1. Display of differentiated LKPD based on Asemblr Edu

7. Develop and select instructional materials

The development of LKPD (Student Worksheets) focuses on geometry concepts, specifically cubes and cuboids, by integrating technology-based learning resources to enhance

students' understanding. The LKPD was created using the Canva application, featuring a visually appealing design and user-friendly layout. To make learning more interactive, the LKPD incorporates QR codes that are linked to various digital learning tools from the Assemblr Edu application. These QR codes provide access to explanations of geometric properties, practice questions, educational games, and instructional videos related to volume calculations.

The development process ensures that each section of the LKPD is aligned with the learning objectives. For instance, the QR codes embedded in the worksheets allow students to scan them using mobile devices, which opens interactive Augmented Reality (AR) experiences. Through AR, students can visualize 3D models of cubes and cuboids, enabling them to explore geometric properties in an engaging and hands-on manner. This approach facilitates better comprehension and helps students apply their knowledge to solve problems effectively, making learning both dynamic and enjoyable.

8. Design and conduct formative evaluation of instruction

Product design in the development of Dick and Carey begins with designing the concept and content to be used. Formative evaluation through pretests to determine initial abilities and posttests to determine differences in pretest results. The following is a display of the product that has been designed and tested. The results of student responses from the trial of differentiated LKPD based on Assemblr Edu can be seen in the following table:

Table 2. Results of teacher and student responses

Trials	Number of Respondents	Total Score	Percentage amount	Average Percentage	Criteria
Small group test	5	440	440	88	Good
Medium Group Test	15	1215	1215	81	Good
Large group test	25	2025	2025	81	Good

The small group had the highest average percentage (88%), suggesting the group performed excellently. Both the medium and large groups had an average percentage of 81%, which is still a solid score but a bit lower than the small group's performance. All groups are rated as "Baik" (Good), which reflects a positive outcome for all tested groups, despite some variance in individual performance across group sizes.

9. Instruction revision

Revisions at this stage include all previous steps based on input, criticism, and suggestions from media experts and educators by looking at the results of field observations of the media being developed to obtain effective learning media.

Table 3. Product Revisions

Revision	Before	After
The writing has been revised to make it easier to read.		
Add usage instructions to LKPD.		

10. Design and conduct summative evaluation

Based on the results of small group, medium group, and large group trials, teachers at UPT SDN Srirahayu said that designing using the Canva application was very good and useful for teachers in creating differentiated LKPD based on Edu assembly, and its integration into printed LKPD made it easier for students to understand it.

DISCUSSION

The research on the development of differentiated LKPD based on Asemblr Edu aims to create a learning environment that caters to the diverse needs of students, including their talents, interests, and learning styles. The development of this LKPD is focused on ensuring that students' readiness, interests, and talents are effectively addressed, allowing them to engage with the content in a way that suits their individual learning preferences and strengths. This approach ensures that each student receives personalized learning opportunities, enhancing their overall educational experience.. Meanwhile, research conducted by (Nabilla et al., 2022) focuses on the development of interactive E-LKPD based on digital literacy to improve students' critical thinking skills in social arithmetic material. This study highlights the aspects of two-way feedback and the effectiveness of media in helping students' learning completion. Research conducted by (Kurnia Sari et al., n.d.-b), Highlights the use of Augmented Reality (AR) technology in LKPD for historical material (Hindu, Buddhist, and Islamic Heritage) aimed at elementary school students. The main focus is on visual-based learning innovation and immersive technology. Meanwhile, research was conducted by (Putri Ayunda et al., n.d.). Using the Kodular application for the development of E-LKPD based on Android technology in mathematics subjects for grade VIII. This study focuses on creating applications concerning the 4D model, especially to support learning with mobile-based technology devices. From several studies conducted, the novelty of this study lies in the combination of differentiated learning approaches, integration of Assemblr Edu technology. The

focus on personalizing learning for elementary school students with spatial mathematics material creates a unique contribution to the development of innovative technology-based learning media.

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