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Validation of Augmented Reality Development Instruments for Earth and Solar System Material in Junior High School

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ABSTRACT: This study focuses on the validation of Augmented Reality (AR) development instruments for teaching Earth and Solar System concepts in junior high school. AR technology is increasingly being utilized in education to enhance student engagement and improve conceptual understanding. The research employs the ADDIE development model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. The validation process involved expert reviews and field trials with students and teachers. The results indicate that the developed AR learning media is valid and effective, with an Aiken's V value of 0.85, demonstrating high reliability. The use of AR significantly enhances students' comprehension of abstract concepts, motivation, and learning interest. The findings suggest that AR-based learning media can be an effective tool in improving students' academic performance. Further research is recommended to expand AR applications to other subjects and conduct broader evaluations to maximize its potential in educational settings.

KEYWORDS: Augmented Reality, Learning Media, Earth and Solar System, Educational Technology, ADDIE Model..

1. INTRODUCTION

Technology is increasingly developing over time and everything including the world of education uses technology to make work easier. Technology is one of the tools used in education to help teachers facilitate teaching that produces the desired outcomes for students. Technology is not only used as a tool to achieve educational goals but also as a provider of characteristics of progress in the field of education in a country (Haryanto, 2015) Educational technology involves people, processes, ideas, equipment, and organizations to analyze problems, find ways to solve them, and implement, evaluate, and manage solutions to problems that cover all aspects of human learning can be understood as a complex and integrated process (Pd & Widodo, 2015) . In relation to learning, educational technology strengthens in engineering various methods and techniques from the design stage, development, utilization of various learning resources, implementation, and assessment of programs and learning outcomes (Pratomo & Wahanisa, 2021) . In this classroom learning process, it is closely related to the interaction between students and educators/teachers in a learning environment. The interaction of teaching and learning in the classroom cannot be separated from the influence of the media used by teachers in delivering teaching materials. Learning media plays an important role in creating effective, interactive, and interesting learning. The use of appropriate media can improve the quality of learning as well as students' motivation and interest in learning. Teachers need to consider learning objectives, student characteristics, and the availability of time and costs in choosing appropriate media. By choosing the right media, learning can be more effective, efficient, and enjoyable for students. (Wulandari et al., 2023)

Currently the media that utilizes technology information and communication has be one of promising elements in the success of the learning process . In learning , if somebody learn the origin draft certain , then through internet help him will to obtain deepening from function and study draft said , how draft the to obtain network or the connection with another concept in review and analyze same problem , this Can done by technology information (Darmawan, 2016) **.** One of the technology that is currently This develop rapid is a smartphone/ cell phone smart . Mobile smart very useful Because allow share information with the world through ability the internet . Currently amount smartphone users are increasing increase and develop every year . Phenomenon increasing smartphone users become challenge at a time opportunity for the world of education specifically for student For help activity Study they . One of them benefit from existence technology This is can used as a learning media . Developing learning media based on technology must done with analyze the content of structure curriculum subjects moreover

previously (Darmawan, 2016) . Many learning media educational developed with One of the technologies is Augmented Reality (AR).

Augmented reality aims For develop technology that can integrate digital content produced computer to in the real world in real time. There are several important things about *Augmented Reality* (AR), namely: the combination of the real and virtual worlds, the integration of virtual objects into the real world, created by computers, closer to the real world (Aini et al., 2021) AR technology today This currently developed No only for computer media only , but also for Android smartphones. Mobile phones clever with system Android operations have Lots advantages , besides own amount many users in Indonesia , android become open source for developers For make application not except For making learning media applications . The use of Android-based learning media is suitable for use as learning media (Putra, 2021) . And AR technology learning media has been proven support classroom learning and also learning independent as well as become a very practical learning medium used (Welli, 2022) .

SMP Negeri 1 Tigo Nagari located at Jalan Lintas Padang Sawah-Kumpulan KM.6, Pasaman Regency, which consists of 21 study groups, is one of the institutions engaged in education by implementing the 2013 curriculum for grade IX and the independent curriculum for grades VII and VIII. The subjects allocated in accordance with the Decree of the Minister of Education, Culture, Research and Technology No. 56 concerning guidelines for implementing the curriculum in the context of learning recovery are 10 subjects and one of them is Natural Sciences (IPA). In the Independent Curriculum, IPA is a separate subject in Phase D. This aims to provide students with wider opportunities to study topics in the fields of physics, chemistry, biology, and earth and space.

Based on the researcher's experience teaching science at SMP Negeri 1 Tigo Nagari, it is known that the learning media used at SMP Negeri 1 Tigo Nagari are diverse. Starting from printed media, audiovisual, laboratory equipment and materials provided by nature are used as media to improve students' understanding of the concepts of the material being studied. Specifically for teaching the material of the earth and the solar system, researchers have only used learning images and videos. The use of learning media such as images and videos is often less effective in improving students' understanding of abstract materials such as "Earth and the Solar System" in high school. This media does not provide a comprehensive and interactive visual representation, making it difficult for students to visualize complex concepts. This could be one of the causes of students' learning outcomes in this subject tending to be low. As seen from the results of the final chapter assessment before remedial, out of 32 students who took the assessment, only 2 to 3 people achieved the completion set by the Science Learning Objective Achievement Criteria (KKTP) at SMP Negeri 1 Tigo Nagari. The following table contains the final assessment data for the Earth and Solar System chapter before remedial activities for class VII semester 2 of the 2023/2024 academic year :

Table 1.

Class	Final assessment scores for the Earth and Solar System chapter	
	Completed	Not Completed
VII.A	2	30
VII.B	3	29
VII.C	2	30
VII.D	3	29
VII.E	2	30

To visualize complex concepts, researchers will design and develop learning media that support learning activities both at school and at home. With the development of this learning media, it is expected that students will be motivated to participate in learning so that their learning outcomes can improve. The learning media that researchers will design is the development of *Augmented Reality* on the Earth and Solar System material. in junior high school. AR can be used to present learning materials in a more interactive and detailed way, resulting in a deeper understanding of abstract concepts. For example, when learning about the solar system, AR can display three-dimensional models of planets that can be viewed from various angles, providing a more realistic and engaging learning experience.

Therefore, the development of *Augmented Reality- based learning media for Earth and Solar System material* for high school students is considered to be an effective solution to improve student learning outcomes. These media not only present information interactively and in detail, but also increase students' learning motivation and interest in the subject matter . If learning activities run well, it will affect academic achievement. Students' academic achievement increased after using media during the learning process, namely Augmented Reality (AR) media (Tasya Yunisha Zuana et al., 2023) . The use of Augmented

Reality (AR)-based learning media improves students' understanding of concepts and their interest in learning (Wiliyanti et al., 2024) .

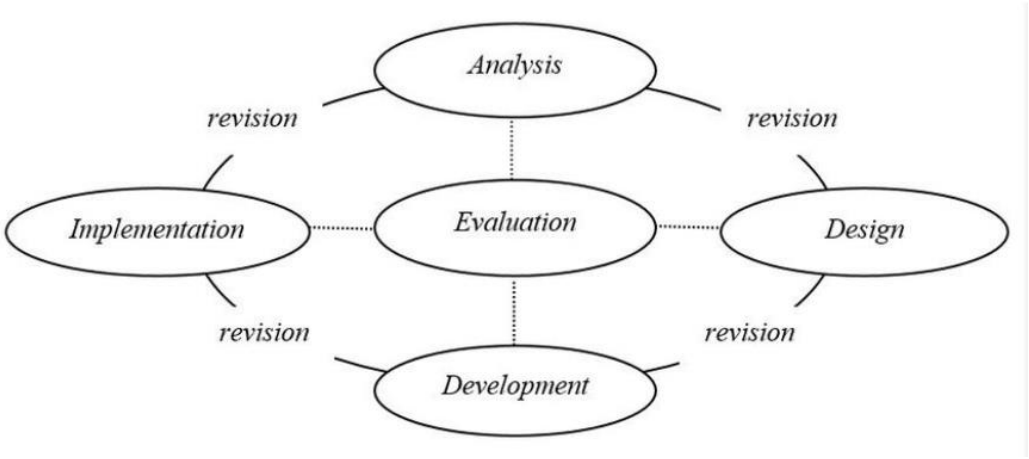
This article focuses on the validation of *Augmented Reality development instruments* on the Earth and Solar System material. The goal is to produce an AR development validation instrument that can be used to collect information about the validation of the development of *augmented reality* (AR) on the earth and solar system material in junior high school.

2. MATERIAL AND METHODS

This research uses a development model or in English it is called Research and Development (R&D). Development research is a research method used to form a particular product, and to test the effectiveness of the product (Sugiyono, 2013) This development research uses the ADDIE model. The ADDIE model consists of five stages including Analysis, Design, Development, Implementation and Evaluation.

Researchers used the ADDIE development model in this development research to produce *Augmented Reality learning media.* (AR) which is designed in stages according to the steps in the ADDIE development model. The material in the AR that will be designed by the researcher is the science subject matter for class VII about the Earth and the Solar System.

The researcher chose to use the ADDIE development method because this development model has advantages in its systematic work stages. Each phase is evaluated and revised from the stages passed, so that the resulting product becomes a valid product. In addition, the ADDIE model is very simple but its implementation is systematic. The ADDIE model development chart can be seen in the following image:



3.1 ADDIE Development Model Chart (Sugiyono , 2015)

The five steps proposed in this model correspond to its acronym, namely:

1) Analyze is analyzing the needs in the learning process to determine the right problems and solutions and determine the competencies of students.

2) Design is determining specific competencies, methods, teaching materials, and learning.

3) Development is producing programs and media that will be used in learning programs.

The prototype design process starts from *paper-based* and in the next stage with *computer - based* . The prototype cycle is as follows: (1) The AR design (prototype) is evaluated by several experts/specialists by filling in the validation sheet and then the prototype is revised according to the suggestions given by the experts; (2) After that, the prototype is tested on a limited basis against 6 students and 2 teachers. Through practicality questionnaire sheet for students and practicality questionnaire sheet for teachers, for them to assess the level of AR usability , then the prototype is revised again according to their suggestions provide ; (3) The next step is to conduct a field trial to measure the effectiveness of AR. through Test sheets for cognitive aspects. If AR is proven to be effective for student learning outcomes, AR will become the final prototype. or final .

The instruments designed in this study consist of: 1) sheets to measure the validity or otherwise of AR; 2) sheets to measure the practicality of AR; 3) student learning outcome assessment sheets to measure the effectiveness of AR.

This research validation sheet needs to distinguish between valid research findings and valid measurements. Valid research findings exist when there is a match between the data collected and the data that actually occurs in the object being studied. Valid instrumentation means that the measuring instrument used to collect data is valid. Valid means that the instrument can measure what it wants to measure. Therefore, a valid instrument is an absolute prerequisite for achieving valid research

results (Hidayati, 2009) . However, this depends on the condition of the object being surveyed and the skills of the person using the equipment.

The following is a validation questionnaire grid for the quality of construction and quality of development of *Augmented Reality* on the Earth and Solar System material in junior high school:

Table 2. Construct quality validation grid

No	Aspect Quality Construct Instrument
1.	Clarity instruction instrument filling
2.	The breadth of coverage of the instrument's construction aspects
3.	Clarity of indicators for each aspect
4.	Clarity of item formulation
5.	Matching of indicators with items
6.	Proportion and adequacy of the number of grains
7.	Simplicity of item formulation
8.	Ease of interpretation/understanding of the points
9.	Readability/ Ease of reading
10.	Standard notation/letter format and layout
11.	Ease of answering
12.	Sentences do not give rise to multiple interpretations
13.	Time/energy efficiency in working
14.	Grammar and spelling are in accordance with Indonesian language rules
15.	Prevent respondents from hidden directions, pressure, embarrassment in answering
16.	Creativity in compiling instruments to obtain objectivity in respondent answers, avoid bias and motivate respondents to answer.

Table 3. AR development quality validation grid

No	Aspect	Indicator
1.	Usability	AR is very helpful in learning activities
		AR has an attractive appearance
		AR is effective in improving the quality of the learning process
		AR can improve the quality of interaction and communication with teachers
		AR is easy to use for Science subjects
		AR makes it easier for students to understand the material on the earth and the solar system
		AR gives the impression of attracting interest and attention.
		AR helps visualize the concept of Earth and Solar System material
2.	**Information Quality**	Augmented Reality (AR) in Earth and Solar System material presents easy information understood
		Information presented in relevant AR with material learning
		AR presents up-to-date information according to development knowledge knowledge
		AR presents clear and unambiguous information confusing
		AR presents information with attractive and supportive visuals understanding
3.	**Interaction quality**	Augmented Reality (AR) allows interaction direct with 3D models of the Earth and Solar System
		AR provides experience more exploration deep compared to other learning media

		AR makes it possible student For manipulate objects (eg. zoom in , rotate , or change perspective)
		AR increases curiosity know and activism student in learning .
		Student can understand difficult concept through interaction with AR model

4). Implementation is carrying out a learning program by applying the design or specifications of the learning program.
5). Evaluation is conducting evaluation of learning programs and evaluation of learning outcomes.

3. RESULTS AND DISCUSSION

Validation carried out by the validator on the instrument study covering aspect Construct. Validation done by two experts or validators, namely 1) Dr. Adlia Alfi Riani, M.Pd 2) Dr. Evrialiani Rosba, M.Pd 3) Dr. Silvia Marni, M.Pd. All validator Also evaluate or validate the overall product being developed.
For scoring of the construct quality validation questionnaire, see the following table :

Table 4. Scoring rules for construct quality validation questionnaires

Information	Score
Very Poor (SK)	1
Less (KR)	2
Doubt (RG)	3
Good (BK)	4
Very Good (SB)	5

The results of the validator's assessment of this instrument can be seen in the table below:

Table 5. Validation Instrument Assessment

Assessed aspects	Validator			s1	s2	s3	∑s	n(c-1)	Aiken's V	Information
	V1	V2	V3							
Item 1	5	4	4	4	3	3	10	12	0,83	Valid
Item 2	4	4	5	3	3	4	10	12	0,83	Valid
Item 3	4	4	5	3	3	4	10	12	0,83	Valid
Item 4	4	4	4	3	3	3	9	12	0,75	Valid
Item 5	5	5	5	4	4	4	12	12	1,00	Valid
Item 6	4	5	5	3	4	4	11	12	0,92	Valid
Item 7	4	5	5	3	4	4	11	12	0,92	Valid
Item 8	4	4	4	3	3	3	9	12	0,75	Valid
Item 9	5	4	5	4	3	4	11	12	0,92	Valid
Item 10	5	4	5	4	3	4	11	12	0,92	Valid
Item 11	5	5	5	4	4	4	12	12	1,00	Valid
Item 12	4	4	5	3	3	4	10	12	0,83	Valid
Item 13	3	4	5	2	3	4	9	12	0,75	Valid
Item 14	5	4	4	4	3	3	10	12	0,83	Valid
Item 15	4	4	4	3	3	3	9	12	0,75	Valid
Item 16	4	4	4	3	3	3	9	12	0,75	Valid
Jumlah	**69**	**68**	**74**	**53**	**52**	**58**	**163**	**192**	**0,85**	**Valid**

From Table 5 results test validity Instrument study from validator on aspect Construction is Valid with mark Aiken's V as big as 0.85. The results of Aiken's calculations range from 0 to 1 and the number 0.600 can be interpreted as having a fairly high coefficient. A V value of 0.85> 0.600 is stated in the valid category. Based on the suggestions given by the validator, a revision was made regarding the use of the abbreviation AR replaced with *Augmented Reality* for all items , adding items to state aspects of time and energy efficiency, so that a valid research instrument is obtained and is worthy of being tested.

4. CONCLUSION

Based on this study, the development of Augmented Reality (AR)-based learning media on the Earth and Solar System material at the junior high school level is proven to be valid and feasible to use. Validation carried out by experts shows that the developed instrument has high reliability with an Aiken's V value of 0.85. With AR, students can more easily understand abstract concepts that are difficult to visualize using conventional learning media such as images and videos. In addition, the use of AR can increase students' motivation and interest in learning, which ultimately has a positive impact on their learning outcomes .

Further research is recommended to develop and test AR on other materials in science or other subjects to determine its effectiveness more widely. In order for the use of AR to be more optimal, teachers need to receive training in integrating this technology into the learning process. Schools need to ensure that there is supporting infrastructure, such as the availability of adequate devices and stable internet access, to support the implementation of AR-based learning media. Periodic evaluation of AR-based learning media is needed to improve its effectiveness based on input from students and teacher users. With this recommendation, it is hoped that Augmented Reality can play an increasingly important role in improving the quality of learning in junior high schools.

REFERENCES

1) Aini, AN, Prasetyowati, D., Prayito, M., Nugroho, AA, & Ariyanti, L. (2021). *Augmented Reality Application Development Using Unity* . PGRI Semarang University.
2) Arikunto, S. (2006). *Basics of educational evaluation* . Bumi Aksara.
3) Darmawan, D. (2016). *Mobile Learning: An Application of Learning Technology* (1st ed., 1st ed.). Jakarta: Rajawali Pers: Rajagrafindi.
4) Haryanto. (2015). *Educational Technology* (First). UNY Press.
5) Hidayati, K. (2009). *Validation of Non-Test Instruments in Mathematics Education Research* .
6) Pd, M., & Widodo, A. (2015). LEARNING TECHNOLOGY. *Nizamia Learning Center* .
7) Pratomo, IWP, & Wahanisa, R. (2021). *Utilization of Learning Management System (LMS) Technology at Unnes During the Covid-19 Pandemic* .
8) Putra, FR (2021). *Submitted as One of the Requirements to Obtain a Bachelor of Education Degree (Strata 1)* .
9) Singarimbun, M., & Effendi, S. (1995). *Survey Research Methodology* (2nd ed.). LPPPES.
10) Sugiyono. (2013). *Educational Research Methods Quantitative, Qualitative and R&D Approaches* . Alfabeta.
11) Tasya Yunisha Zuana, Enoh, & Helmi Aziz. (2023). The Influence of Augmented Reality Media on Learning Outcomes of Islamic Cultural History. Journal of *Islamic Religious Education Research* , 149–154. https://doi.org/10.29313/jrpai.v3i2.3059
12) Welli, AP (2022). Development of Android-based Augmented Reality Learning Media on Virtual Local Area Network (VLAN) material at SMK Negeri 1 Ampek Angkek. *UPGRISBA* .
13) Wiliyanti, V., Ayu, SN, Noperi, H., & Suryani, Y. (2024). A SYSTEMATIC LITERATURE REVIEW: THE EFFECT OF AUGMENTED REALITY-BASED LEARNING MEDIA ON STUDENTS' CONCEPT UNDERSTANDING AND LEARNING INTERESTS. *Journal of Science Education* .
14) Wulandari, AP, Salsabila, AA, Cahyani, K., Nurazizah, TS, & Ulfiah, Z. (2023). The Importance of Learning Media in the Teaching and Learning Process. *Journal on Education* , *5* (2), 3928–3936. https://doi.org/10.31004/joe.v5i2.1074
15) Ngalim Purwanto, M. 1927-. (1990). *Educational psychology / Ngalim Purwanto* . Bandung :: Rosdakarya Youth.
16) Singarimbun, Masri; Sofian Effendi. (1982). *Survey research methods / editor, Masri Singarimbun, Sofian Effendi* . Jakarta :: LP3ES,.