INTERNATIONAL CONFERENCE PROCEEDINGS
UNIVERSITAS ISLAM BALITAR BLITAR
Empowering Education and Society through Digital Transformation
Volume 1 (2025)

Development of Magnetic Force Augmented Reality at Elementary Schools: A Research and Development

Muhamad Kevin Akbar[1], Marinda Sari Sofiyana[2], Ida Putri Rarasati[3]

Universitas Islam Balitar

Keywords:
Augmented Reality, Magnetic Force, Research and Development

***Correspondence Address:**
kvnid-4@gmail.com

Abstract: IPAS learning in elementary schools shows a lack of learning media for IPAS lessons, especially for material on magnetic force.This study aims to produce Augmented Reality media products that are suitable for use as learning media on the subject of magnetic force science. This type of research is development research or research and development (R&D) that develops learning media. The study uses the 4D Thiagarajan research model. The stages of this research are Define, Design, Develop. Researchers developed Augmented Reality (AR) media obtained material and Language validation results of 83%, media expert validation of 88%, which overall stated very feasible. In addition, the results of the teacher's readability test were 95% which fell into the very feasible category. In addition to the readability test to teachers, a readability test was also conducted on students with a percentage of 89% in grade IV and 94% in grade V, which fell into the very feasible category. This research contributes to the development of learning media that utilizes augmented reality technology.

INTRODUCTION

Science and Social Sciences (IPAS) is a subject implemented during the Independent Curriculum in elementary schools. It combines two subjects: Natural Sciences (IPA) and Social Sciences (IPS). Therefore, Science and Social Sciences (IPAS) can be shortened to IPAS. Learning IPAS utilizes technology and information-based media. The relationship between these two subjects lies in their fundamental nature: nature and the positive reciprocal relationships between humans. According to Rusilowati (2022), students' literacy and numeracy competencies can be developed through the subject of IPAS, which relates to everyday life (Afifah et al., 2023).

Preliminary analysis was conducted in three schools, namely SDN Rembang 02, SDN Kepanjenlor 03, and SDN Plosokerep 02. In the preliminary analysis, observations were made on science learning in class IV.

In addition to conducting observations, preliminary analysis was also conducted by interviewing 3 teachers from SDN Kepanjenlor 03, SDN Plosokerep 02, and SDN Rembang 02. The interviews were conducted with Mrs. Nuryani, S.Pd as a fourth grade teacher of SDN Kepanjenlor 02, Mrs. Yuli, S.Pd as a fourth grade teacher of SDN Plosokerep 02 and Mrs. Dewi Khaula S,Pd as a teacher of SDN Rembang 02. According to the fourth grade teacher, the learning material and media that was considered quite difficult was the material on magnetic force.

After conducting interviews with fourth-grade teachers, a questionnaire was distributed to fourth-grade students to determine the media they preferred in science learning. The results of the student questionnaire showed that 69% of students could understand the lesson on magnetic force. 95% of students felt happy when learning used props media. 98% of students felt happy when the teacher used videos during learning. In addition to using teaching aids and videos, 91% of students were also enthusiastic when learning used PPT.

Learning aids are needed to support learning activities. Tools that help teachers deliver lessons are called learning media. For the 4th grade topic on magnetic force, augmented reality (AR) learning media was used. Augmented Reality (AR) is a projection of a virtual world in three dimensions into the real world and can be displayed directly or in real time (Andani, et al., 2024). Rosa, et al. argue that "Augmented Reality" or "AR" refers to technology that combines virtual and physical worlds generated by computers, thereby bringing the boundaries between the two closer. (Andani, et al., 2024). Augmented Reality in the field of education offers various new opportunities in the learning process, such as more interactive learning, a more meaningful and more effective and efficient learning process with the presence of Augmented Reality elements. According to Chen, Looi, and Wu (2021) student learning outcomes can be improved by using augmented reality in the classroom. (Indahsari, Sumirat, 2023). Therefore, it can be said that Augmented Reality is a type of learning media that combines the real world and the virtual world so that students can be active in learning and improve their learning outcomes.

RESEARCH METHODS

The research used by the researcher is research and development (RnD), which develops learning media because this type of research aims to create a product. Thiagarajan's 4Ds (Research and Development) model has four steps or stages in research and development. However, in this study, the researcher only used three stages due to several limitations, such as time, effort, and cost. The Thiagarajan 4D diagram can be seen in Figure 1.

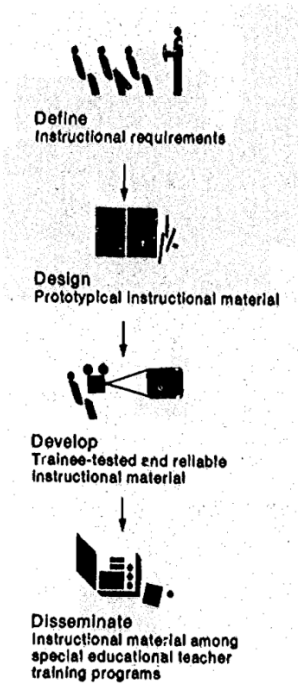

Figure 1. Thiagarajan 4D Chart (1974)

The three stages of research and development (R&D) are as follows:

1. Define

In this stage, the researcher carried out several steps, including:

a) Front-end analysis

In this step, the researcher conducted initial observations in three schools. These initial observations were conducted through interviews and learning observations. The interview and observation instruments used focused on the science and science learning materials and media.

b) Learner analysis

In this step, the researcher distributed questionnaires to students in three schools. The questionnaire instruments used focused on science learning and the media used.

c) Task analysis and learner analysis

The task-based learning objectives (CP) for magnetic force included students utilizing magnetic phenomena in everyday life, demonstrating various types of force and their effects on the direction, motion, and shape of objects. From this CP, learning objectives were derived: students could understand the definition and properties of magnetic force.

d) Specifying Instructional Objectives

After analyzing the data and information, the results of the analysis included potential and problems that were used as objectives for developing learning media.

2. Design

In this stage, researchers begin to design the product. Product design is carried out using the Canva and Assemblr edu applications. Researchers go through several steps, including:

a) Constructing Criterion – Referenced Tests

In this stage, researchers create initial specifications for the media they wish to develop.

b) Media Selection

In this stage, researchers select sources and media that meet student needs and are relevant to initial observation findings. Researchers choose Augmented Reality media, developed using Assembler edu and Canva.

c) Format Selection

The presentation style is adapted to the type of media being created, including instructional design, learning models, and methods.

d) Initial Design

The initial design is created by researchers using selected materials and media and provided with input from the supervising lecturer. Input from

the supervising lecturer will be used to improve the media before production.

3. Develop

This stage aims to develop the revised media. This stage consists of the following two steps:

a) Expert Appraisal

The purpose of this stage is to validate the developed media. The created media will then be assessed by experts. Improvements will be made based on the expert validation results.

b) Development Testing

After revisions, the product will be tested for readability by teachers and students.

RESULTS AND DISCUSSION

A. Validity Test Results, and readability level

1. ARGAMA media validity test results

Media validity is obtained from the results of the validation sheet given to the validator, including media experts, material experts, and language experts. The assessment results from 3 expert validators in material and language obtained a total score of 188 out of a maximum score of 225. The percentage obtained based on the total score was 83% so it is included in the very suitable category and does not need to be revised from the criteria $80 \leq x \leq 100\%$. The assessment results from 3 media expert validators obtained a total score of 132 out of a maximum score of 150. From the total score obtained, a percentage of 88% was obtained so that it is included in the very feasible category, no revision is needed from the criteria $80 \leq x \leq 100\%$. For complete results, please see the table below.

Table 1. Results of material and language validation

Nomor Pernyataan	Validator 1	Validator 2	Validator 3	Total Skor

1	5	4	5	14
2	5	3	4	12
3	5	3	4	12
4	5	4	5	14
5	5	4	5	14
6	5	3	4	12
7	5	3	4	12
8	4	3	4	11
9	5	3	4	12
10	5	4	4	13
11	5	3	4	12
12	4	3	4	11
13	5	4	4	13
14	5	4	4	13
15	5	4	4	13
Total Skor				**188**
Skor Kriteria				**225**
Presentase				**83%**

Table 2. Media validation results

Nomor Pernyataan	Validator 1	Validator 2	Validator 3	Total Skor
1	5	5	5	15
2	4	3	5	12
3	4	4	4	12
4	5	5	5	15
5	3	3	5	11
6	5	5	5	15
7	4	4	5	13
8	3	5	5	13
9	4	4	5	13
10	3	5	5	13
Total Skor				**132**
Skor Kriteria				**150**
Presentase				**88%**

2. ARGAMA media readability level.

The readability test was obtained from the responses of teacher and student questionnaires. The total score of the teacher's readability questionnaire was 114 out of a maximum score of 120, resulting in a percentage of 95%. Based on the criteria for the level of practicality based on the readability test, 95% fell within the range of $80 \leq x \leq 100\%$, thus falling into the very practical category. The results of the Grade IV Student Readability Questionnaire obtained a total score of 282 out of a maximum

score of 315, thus falling into the percentage of 89%. Based on the criteria for the level of practicality based on the readability test, 89% fell within the range of 80 ≤ x ≤ 100%, thus falling into the very practical category. The results of the Grade V Student Readability Questionnaire obtained a student readability questionnaire score of 299, thus falling into the percentage of 94%. Based on the criteria for the level of practicality based on the readability test, 94% falls within the range 80 ≤ x ≤ 100% so it is included in the very practical category. For complete results, please see the table below.

Table 3. Results of the Teacher Readability Questionnaire

Nomor Pernyataan	1	2	Jumlah
1	5	5	10
2	5	5	10
3	5	5	10
4	5	5	10
5	5	5	10
6	5	5	10
7	4	4	8
8	5	5	10
9	5	5	10
10	4	5	9
11	4	4	8
12	5	4	9
Total Skor			**114**
Skor Kriteria			**120**
Presentase			**95%**

Table 4. Results of the Grade IV Student Readability Questionnaire

Nomor Pernyaataan	1	2	3	4	5	6	7	8	9	Jumlah
1	4	4	5	4	5	5	5	5	5	42
2	5	3	5	3	5	5	3	5	5	39
3	5	3	5	4	5	5	3	5	5	40
4	4	4	5	4	5	5	3	5	5	40
5	4	4	5	3	5	5	3	5	5	39
6	4	4	5	4	5	5	4	5	5	41
7	5	5	5	4	4	5	3	5	5	41
Total Skor										**282**
Skor Kriteria										**315**
Presentase										**89%**

Table 5. Results of the Grade V Student Readability Questionnaire

Nomor Pernyaataan	1	2	3	4	5	6	7	8	9	Jumlah
1	5	5	5	5	4	4	5	5	5	43
2	5	5	5	4	4	4	5	5	4	41
3	3	5	5	5	4	4	5	5	5	41
4	4	5	5	5	5	5	5	5	5	44
5	5	5	5	5	5	4	5	5	4	43
6	4	5	5	4	5	5	5	5	5	43
7	5	5	5	5	5	5	5	5	4	44
Total Skor										**299**
Skor Kriteria										**315**
Presentase										**94%**

B. Discussion

1. ARGAMA media validity test results

The assessment results from 3 expert validators in material and language obtained a total score of 188 out of a maximum score of 225. The percentage obtained based on the total score was 83% so it is included in the very suitable category and does not need to be revised. The validation results by three media experts obtained a percentage of 88% with a range of 100%. The percentage obtained by ARGAMA media of 88% is said to be very appropriate. This is supported by the statement of Rosa et al. who argue that "Augmented Reality" or AR refers to technology that combines the virtual and physical worlds generated by computers, thereby narrowing the boundaries between the two (Andani et al. 2024). According to Hamka (2018), learning media is a physical or non-physical technology that functions as an intermediary between teachers and students to convey learning content more effectively and efficiently.

2. ARGAMA media readability level.

The media trial was conducted by assessing the readability of teachers and students. The trial was conducted at SDN Kepanjenlor 03. The trial was conducted with teachers in grades 4 and 5. The results of the teacher readability questionnaire were 95%, which falls into the very practical category. The trial was also conducted on students in grades 4 and 5. From the results of the readability questionnaire, the students got a

percentage of 89% in grade 4 and 94% in grade 5. The percentages of 89% and 94% are in the very practical category. According to Nieveen (2010), a product developed is considered practical if teacher and student users state that the product is easy to use. The development of augmented reality learning media has also been carried out by (Tawil, 2024). With the title Development of Augmented Reality-Oriented Digital Learning Media for Science Subjects for Grade 6 Elementary Schools in 2024, which obtained results from trials with students of 96.25% with a very practical category with a score range of 81.00%-100.00%.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusion
   A. Feasibility Based on ARGAMA Development Validity

      The ARGAMA (Augmented Reality Magnetic Force) media is available for teachers and students. For teachers, there is a teaching module. There are two sessions for students. Session 1 covers the introduction to magnetism, including the definition of magnets, magnetic poles, magnetic properties, magnetic fields, and types of magnets. In addition to the introduction to magnetism, there is a quiz. Session 2 includes a video on the benefits of magnets in everyday life and a quiz. Based on the validation results of the material, media, and language, a percentage of above 80% falls into the very feasible category without revision.

   B. Practicality Based on Teacher and Student Readability Results

      The ARGAMA (Augmented Reality Magnetic Force) media is considered very practical for teaching magnetic force, according to the findings of readability tests for teachers and students. The percentage obtained was 95% in the teacher readability questionnaire, 89% in grade IV, and 94% in grade V in the student readability questionnaire.

2. Recommendations

Based on the conclusions presented, the researcher offers the following recommendations.

1) This research product can serve as a reference for teachers creating augmented reality media with different materials, illustrations, and learning methods.
2) Schools can add facilities such as a stable internet connection and Chromebooks.
3) Future researchers can test and continue this research by evaluating the effectiveness of the ARGAMA media.
4) Future researchers can use ARGAMA as a reference for creating similar media with different materials.
5) Future researchers can use the assembler edu pro website to create augmented reality, as it has more features and a more comprehensive set of 3D assets, allowing for the development of better products.

REFERENCES

Afifah, Nur Muvidah Siti, dkk, 2023, INOVASI MEDIA PEMBELAJARAN UNTUK MATA PELAJARAN IPAS, Kota Semarang : Cahya Ghani Recovery

Alifa, Isra Zarida, Sufyadi, Susanti, Utama, Hadi Agus, 2024, PEMANFAATAN CHROMEBOOK SEBAGAO PENUNJANG PEMBELAJARAN BAGI SISWA DI SMPN 1 BANJARMASIN, Jurnal Teknologi Pendidikan, Vol. 23. No. 02, 118

Andani, dkk, 2024, TEKNOLOGI AUGMENTED REALITY UNTUK MEDIA PEMBELAJARAN, Surabaya : Cipta Media Nusantara

Borg, W. R., & Gall, M. D. (1983). Educational Research: An Introduction, 4th edition

Harahap, Mon Feby Olivia, dkk, 2022, MEDIA PEMBELAJARAN TEORI DAN PERSPEKTIF PENGGUNAAN MEDIA PEMBELAJARAN DALAM

PEMBELAJARAN BAHASA INGGRIS, Sumatra Barat : CV.AZKA PUSTAKA

Hasbi, Muhammad, 2022, MODUL PEMANFAATAN CHROMEBOOK, Kementrian Pendidikan, Kebudayaan, Riset dan Teknologi Republik Indonesia

Indahsari, Leoni, Sumirat, 2023, IMPLEMENTASI TEKNOLOGI AUGMENTED REALITY DALAM PEMBELAJARAN INTERAKTIF, Jurnal Komunikasi dan Media Pendidikan, 8

Kresnadi, Hery dkk, 2023, PEMANFAATAN CHROMEBOOK DALAM PEMBELAJARAN IPAS DI SEKOLAH DASAR NEGERI 18 SUNGAI KAKAP, Jurnal Pendidikan Dasar Perkhasa, Vol. 09, No. 01, 3

Magdalena, Ina, dkk, 2021, TULISAN BERSAMA TENTANG MEDIA PEMBELAJARAN SD, Sukabumi : CV Jejak, anggota IKAPI

Mulyasa, 2023, IMPLEMENTASI KURIKULUM MERDEKA, Jakarta Timur : PT Bumi Aksara

Nurfadhillah, Septy, 2021, MEDIA PEMBELAJARAN, Sukabumi : CV Jejak, anggota IKA

Paggara, Hamzah, dkk, 2022, MEDIA PEMBELAJARAN, Badan Penerbit UNM

Purnasari, Dheni Pebria, Sadewo, Damas Yosua, 2020, PEMANFAATAN TEKNOLOGI DALAM PEMBELAJARAN SEBAGAI UPAYA PENINGKATKAN KOMPETENSI PEDAGOGIK, Jurnal Publikasi Pendidikan, Vol. 10, No. 3, 189 – 190 https://core.ac.uk/download/pdf/388995085.pdf

Rahman, dkk, 2022, PENGERIAN PENDIDIKAN, ILMU PENDIDIKAN, DAN UNSUR – UNSUR PENDIDIKAN, Jurnal Al Urwatul Wutsqa, Vol. 2 No. 1, 2 – 3

Saputro, Budiyono, 2021, BEST PRACTICES PENELITIAN PENGEMBANGAN, Lamongan : Academia Publication

Thiagarajan., & S. (1974). Instructional Develoment for Traning Teacher of Exeptional Children: A Sourcebook (p. 194).

Wati, E. R. 2016. Ragam Media Pembelajaran. Jakarta: Kata Pena.