



Development of student worksheets based on Augmented Reality Sub Material Phases of the Moon to Increase Student Learning Motivation

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Abstract: This study aims to design and create teaching materials in the form of Student Activity Sheets based on Augmented Reality technology in the Moon Phases sub-material, in order to increase student motivation. The research design used is a Research and Development (R&D) type with a 4-D model consisting of four stages, namely, Define, Design, Develop and Disseminate. The subjects in this study consisted of 30 students of class VII MTs Negeri 1 Jember. The results of this study at the product feasibility level showed a kappa moment in terms of content feasibility, presentation feasibility, and language feasibility showing an average value of 0.81 with a very high eligibility category, which means that student worksheets can be used in school learning. Furthermore, the average result of the practicality level of Augmented Reality-based student worksheets products from the aspects of convenience, efficiency, and benefits is 0.83 for teachers and 0.83 for students with very high practicality categories. Thus the developed Augmented Reality-based Student Activity Sheets can help learning more efficiently and make students more interested and motivated to learn.

Keywords: Augmented Reality; Motivation to Learn; Student Worksheets

Introduction

Natural sciences (IPA) are a body of systematic theories that only apply to natural occurrences. They require a scientific mindset that includes openness, honesty, and curiosity because they are created and developed through scientific methods like testing and observation (Safitri et al., 2019). Physics is a part of the natural sciences that evolves via the use of scientific methods such as observation, formulation of issues, hypothesis generation, hypothesis testing, conclusion, and creation of theories and concepts (Sa'diah et al., 2022). Learning physics will direct students in finding facts, principles, theories, or mastering the concepts of physics material (Ibnusaputra et al., 2023). The study of physics has the potential to solve issues since it frequently finds application in daily life. Learning's focus of study Students may find it challenging to understand

some abstract concepts in physics because it deals with inanimate objects and related natural processes (Rizaldi & Jufri, 2020). The research results of Jamaluddin et al., (2018) showed that students' academic abilities had a very significant effect on students' understanding of science concepts. The teacher must take this into account in order to facilitate learning and meet learning goals.

It is vital to have instructional resources to promote learning in order to develop active learning and encourage students' motivation to understand physics ideas. Material that has been organized and prepared for distribution to students is referred to as teaching material. The Student Worksheet is one of the instructional items that is effectively used in classrooms. Student Worksheet is printed teaching material that includes summary sheets of the topic, practice questions, example questions, and instructions for completing assignments (Rohani, 2019). Student Worksheet is

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instructional material that has been set up so that students can study it on their own (Pratama et al., 2019). Research conducted by Hamidah (2023) shows that student worksheets are deemed suitable for use as learning media. Student worksheets can be created in an engaging way to boost motivation for learning. Students are motivated to identify variables, collect data, analyze data, and conclude (Asbanu, 2023).

The word "motivation" is derived from the Latin word "movere," which meaning "to encourage or drive." Motivation as the driving force that converts a person's energy into a type of physical action in order to accomplish particular aims (Arianti, 2019). Students who are pushed to complete learning activities about something in order to maximize learning success are said to be motivated to learn (Nasshar 2004:42). The learning process can be said to be carried out well if it is able to motivate students to actively participate in learning (Nuramalina et al., 2022).

The use of augmented reality technology, according to Zulfahmi's study, may boost students' motivation to learn (Zulfahmi, 2020). It is possible to use augmented reality on both PCs and mobile devices. Augmented reality is frequently employed in school materials, medical, and mobile navigation. In contrast to computer-generated reality, which turns real objects into virtual ones, augmented reality (AR) technology combines virtual objects in the real world. It will be very helpful in delivering data to users and follows nearly the same rules as 3D virtual reality (Hakim, 2018).

Augmented Reality-based student worksheets teaching materials are one of the innovations in learning today. With the development of this Student Worksheets, it is hoped that it can increase students' motivation in learning, especially for material that has an abstract nature. Students will be interested in the learning process and will easily find the concepts of the material presented by the teacher. Research conducted by Widiasih (2023) shows that in the development of Augmented Reality-based learning media, students understand the material more easily after being given treatment in the form of Augmented Reality media on the concept of eye optics.

This development research will be able to make students have high learning motivation in the learning process. In accordance with research conducted by Sari et al., (2022) that students have a great sense of enthusiasm to engage with Augmented Reality experiences, where users report that they feel more satisfied, have more fun. Thus, it is important to carry out this research to increase students' learning motivation, by creating teaching materials in the form of innovative student worksheets.

Method

Methods and research design should be made explicit. This research is classified as Research and Development (R&D) using Thiagarajan's 4-D Model, which has four stages: Define, Design, Develop, and Disseminate (Maydiantoro, 2020). The research and development of the Augmented Reality-based Student Worksheet is carried out up until the develop stage, which is only concerned with the product's viability and feasibility. The flow of research carried out is in figure 1.

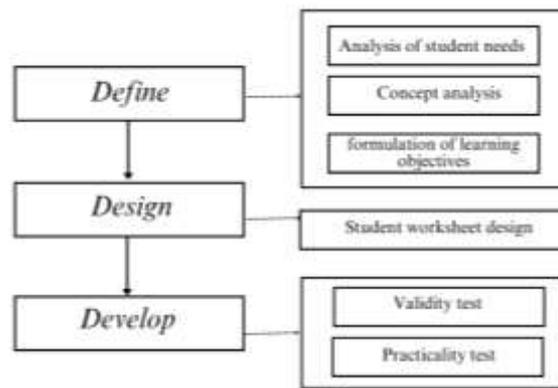


Figure 1. Research stage

The demands of students in learning science in the classroom are examined at the define stage. The design stage, where teaching material goods in the form of "Augmented Reality-based Student Worksheet " are designed, comes next. And at this point, the develop stage—more specifically, product development—aims to create a product that is workable and useful so that it may be applied to the teaching and learning process.

At the define stage, an analysis of the needs of students in learning science at school is carried out. Followed by the design stage, which is the stage of designing teaching material products in the form of "Augmented Reality-based LKPD", at this stage improvements are made based on input and suggestions from experts, then trials are carried out to test and perfect the product (Alika & Radia, 2021). And the develop stage, namely product development, at this stage the aim is to get a feasible and practical product so that it can be used in the learning process.

The subjects of this study consisted of 30 class VII students of MTs Negeri 1 Jember. The instruments used in the research are validation and practicality questionnaires. The results of the instrument are then processed using the Kappa Cohen formula as follows:

$$momenkappa(k) = \frac{po - pe}{1 - pe} \tag{1}$$

Information:

k = kappa moment indicating product validity.

p_o = proportion that is realized, calculated by means of the number of values given by the validator divided by the maximum number of values.

p_e = unrealized proportion calculated by means of the maximum value minus the total number of values given by the validator divided by the maximum number of values.

The interpretation of the kappa moment value can be seen in Table 1 as follows.

Table 1. Decision categories based on kappa moments (k)

Interval	Description
0.81 - 1.00	Very High
0.61 - 0.80	High
0.41 - 0.60	Low
0.21 - 0.40	Very Low
0.01 - 0.20	Invalid

Result and Discussion

Define

The define stage is produced based on an analysis of the needs of students, concept analysis and the formulation of learning objectives. In accordance with Kuswanto (2023) the first stage begins with an analysis of student conditions, curriculum, concepts and concept maps. Analysis of the needs of students was carried out by interviewing science teachers at MTs Negeri 1 Jember and a needs analysis questionnaire filled out by students. This stage results that in science learning students still have difficulty finding concepts in abstract material, for example, the Solar System material because this material has very large dimensions. However, in class learning they do not use Student Worksheets specifically designed for the Solar System material. Thus, supporting teaching materials are needed to support the delivery of the material. The teaching materials chosen in this study are Student Worksheets based on Augmented Reality technology. Research by Indrawan et al. (2021) states that Augmented Reality has a feature to convert information into visual form, so that by utilizing this technology, students will receive learning in a visual form that is easy to understand.

The next stage is the concept analysis stage which determines the material to be presented (Firdausi et al., 2023). A concept map of the Solar System's content was produced as a consequence of the idea analysis. The sub-matrix of the Moon's phases and their impact on daily life, packed in Student Worksheet based on augmented reality, is then used in the construction of learning objectives from this information. Students are thus

encouraged to learn and pay attention to the offered visuals in order to accurately understand their own notions. According to Putri and Festiyed (2019), they report that independent learning is needed in the current advancement of technology and information, if students fail to build independence in learning it will have an impact on student success.

Design

Currently, the design process is what creates the first iteration of the student worksheets based on augmented reality and the sub-subject of the Moon phases. The development stage is the initial design of an augmented reality-based student worksheet product which has been validated by media experts and material experts with several aspects validated and then revised according to input and suggestions used to improve and increase the quality of the product being developed (Rery & Marinsi, 2022). The next stage is to make improvements based on input and suggestions from experts, then trials are carried out to test and perfect the product.

The augmented reality content for the student worksheets is designed using Canva and Assemblr in accordance with the student worksheet creation requirements. Figure 1 depicts how student workbooks are formatted.



Figure 2. Student Worksheet Cover

Develop

The purpose of the validity test was to gauge the degree of viability of the created student worksheet instructional materials. Validators are professionals or experts with the knowledge to evaluate students' augmented reality-based worksheets. Three different elements make up this measurement: language

feasibility, presentation feasibility, and content feasibility. Figure 2 displays the outcomes of the student worksheet validation test.

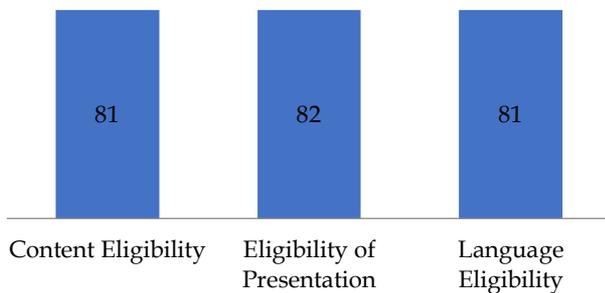


Figure 3. Graph of validity test results by the validator

The student worksheet's feasibility section, which is based on augmented reality moon phase material, has a very high category kappa moment value of 0.81. Thus, the created student worksheets are practical and in line with the requirements of fundamental competencies. Additionally, the phrases in the student worksheets can help students understand the material notion of the moon phases and how they affect daily life. The presentation of the content in the worksheets is also acceptable.

The presentation portion of the Augmented Reality-based student worksheets has a kappa moment value of 0.82 and is categorized as extremely high. So, starting with the title, KI, KD, GPA, and learning objectives, the created student worksheets have been methodically grouped in accordance with the components of student worksheet preparation. Students learn more easily while using student worksheets based on augmented reality to locate relevant ideas. The language portion of the augmented reality-based student workbooks has a kappa moment value of 0.81 and is categorized as extremely high. As a result, the student worksheets created followed the norms of writing and used the appropriate terminology. Additionally, questions are stated clearly and consistently in student workbooks utilizing symbols.

The three components' average kappa moment is 0.81, with a very high feasibility category. Students' augmented reality-based worksheets for class VII SMP can be utilized for learning based on these categories. continue to the revision stage after completing the feasibility test. This modification tries to fix the section of the student worksheet that the validator thought was unsuitable before the trial was conducted. The following changes were made to the student worksheets: Changing the worksheet names for students to more intriguing ones; Adding At MTs Negeri 1 Jember, 30 students in class VII and two science professors evaluated a practicality questionnaire to collect data for

the practicality test phase. Figure 4 displays the outcomes of teachers' and students' practicality data analysis on student worksheets based on augmented reality.

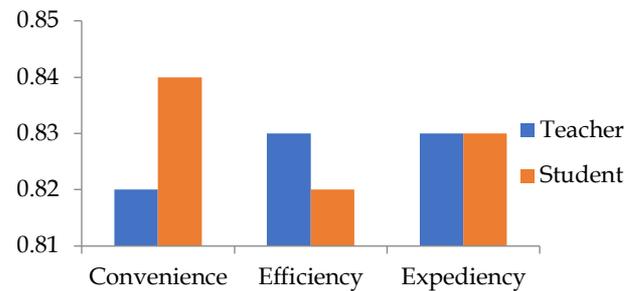


Figure 4. Graph of practicality data analysis

Based on the graph of the results of the Augmented Reality-based LKPD practicality data analysis which consists of three components. First, the ease of use component of Augmented Reality-based LKPD has a kappa moment value of 0.82 for teachers and 0.84 for students in the very high category. Second, the time efficiency component based on Augmented Reality has a kappa moment value of 0.83 by teachers and 0.82 by students in the very high category. Third, the molecular form of the LKPD benefit component has a kappa moment value of 0.83 by teachers and 0.83 by students in the very high category.

In the extremely high practicality category, the average score on the Student Worksheet practicality test based on augmented reality was 0.83 for teachers and 0.83 for students. As a result, the created Augmented Reality-based Student Worksheet can aid in more effective learning and increase students' interest in and motivation for studying. Additionally, the tasks included in the produced Student Worksheet can assist teachers train students' thinking skills while guiding them as they learn new concepts. The Augmented Reality-based Student Worksheet for class VII SMP is workable and usable in schools based on the three examined components.



Figure 5. Implementation of student worksheets in learning



Figure 6. Application of augmented reality to student worksheets

After being evaluated for suitability and usefulness, augmented reality-based Student Worksheet products are next tested using a learning motivation questionnaire to gauge students' interest for learning. Table 2 displays the findings from the assessment of students' motivation for learning.

Table 2. Results of practicality data analysis

Learning Motivation Indicator	Score
There is desire and desire to succeed	0.81
There is a drive and need for learning	0.81
There are interesting activities in learning	0.84
There is a conducive learning environment	0.82
Average	0.82

A kappa moment value of 0.82 with a very good category was found for the test findings of students' learning motivation from the learning motivation indicator. Students in MTs Negeri 1 Jember may be more motivated to learn if they participate in Student Worksheet based on Augmented Reality and the sub-material of Moon phases.

Conclusion

Based on the results of the analysis that has been done, it can be concluded that the Augmented Reality-based student worksheets is very valid for increasing students' learning motivation. The kappa moment value

is 0.81 for the very feasible category. The value of the kappa moment is 0.83 for the teacher and 0.83 for the students in the very practical category. Tests for increasing student learning motivation resulted in a kappa moment value of 0.82, which means that the student worksheets that has been developed can increase student learning motivation.

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Author Contributions

The author is involved in the overall making of this article

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Conflicts of Interest

The authors declare no conflict of interest.

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