



Development of Investigation Based Multiple Representation (IBMR) LKPD on Straight Motion Material for Grade X SMA/MA

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ABTRACK

The development of LKPD (Student Worksheets) based on Investigation Based Multiple Representation (IBMR) for straight motion material at the SMA/MA Grade X level is motivated by a needs analysis of students. Based on this needs analysis, it was found that there is a lack of media used in physics learning activities, especially in straight motion material, which causes students to struggle to understand the subject matter. This study aims to describe the design of LKPD based on IBMR in straight motion material and to assess the feasibility level of the LKPD based on IBMR in straight motion material. This research is a type of development research using the 4D research model. The subjects of the study include media experts, content experts, and learning device experts. The data collection instrument used in this research is an expert validation sheet. The results of the feasibility percentage from the media expert were 74%, categorized as feasible, while the feasibility percentage from the content expert was 97.33%, categorized as very feasible, and the validation result from the learning device expert showed a percentage of 89.35%, categorized as very feasible. Thus, it can be concluded that the LKPD based on IBMR (Investigation Based Multiple Representation) for straight motion material at the SMA/MA Grade X level is categorized as very feasible for use.

Keyword: Development, Student Worksheets, Investigation Based Multiple Representation, Straight Motion

ABSTRAK

Pengembangan LKPD berbasis *Investigation Based Multiple Representation* (IBMR) pada materi gerak lurus tingkat SMA/MA Kelas X dilatar belakangi oleh analisis kebutuhan pada peserta didik, berdasarkan analisis kebutuhan ditemukan bahwa kurangnya media yang digunakan dalam kegiatan pembelajaran fisika terutama pada materi gerak lurus menyebabkan peserta didik sulit dalam memahami materi pelajaran. Penelitian ini bertujuan untuk mendeskripsikan desain LKPD berbasis IBMR pada materi gerak lurus serta untuk mendeskripsikan tingkat kelayakan LKPD berbasis IBMR pada materi gerak lurus. Penelitian ini merupakan jenis penelitian pengembangan dengan menggunakan model penelitian 4D. Subjek penelitian yang digunakan adalah dosen ahli media, dosen ahli materi, dosen ahli perangkat pembelajaran. Instrument pengumpulan data yang digunakan dalam penelitian ini berupa lembar validasi ahli. Hasil persentase kelayakan dari ahli media adalah sebesar 74% dengan kategori layak, kemudian hasil persentase kelayakan dari ahli materi sebesar 97,33% dengan kategori sangat layak, dan hasil validasi ahli perangkat pembelajaran diperoleh persentase 89,35% dengan kategori sangat layak. Dengan demikian dapat disimpulkan LKPD berbasis IBMR (*Investigation Based Multiple Representation*) pada materi gerak lurus tingkat SMA/MA kelas X dikategorikan sangat layak untuk digunakan.

KATA KUNCI:

Penembangan, LKPD, IBMR, Gerak lurus



1. Introduction

The success of learning is influenced by various factors that affect the learning process of students, both internal and external. Internal factors refer to those present within the student, including motivation to learn, orientation, and interest in new things related to physics. External factors relate to the teacher, such as the curriculum, teacher-student interactions, teaching models, teaching materials, and the delivery methods applied by the teacher (Karlina Dwi Susanti et al., 2016). Student motivation will be maintained if students can find a connection between what they learn and its benefits in meeting personal needs or aligning with their beliefs, thus fostering a strong desire to understand physics concepts (Nurmalita Sari et al., 2018). Learning activities are also designed to support and prepare students for advancements in information technology, enabling them to implement these skills in both learning processes and everyday life (Edi Syahputra, 2018).

Engaging learning is one that captures students' attention on the material being presented. There are many strategies in learning that can enhance student interest, such as role-playing, talking sticks, and crossword puzzles. One approach teachers can take is to develop learning media that serve as resources for students, for example, using animated films or interactive methods to explain material. This way, complex and tedious subjects become easier to digest, as students are attracted to the delivery media used. If educators can effectively develop learning media, the resources will align with the curriculum demands and can also cater to the needs of students, such as types of learning material that encompass knowledge (facts, concepts, principles, procedures), skills, and attitudes or values (Rizka Apriyani Putri et al., 2018).

Based on the needs analysis conducted by the researcher at SMA N 12 Banda Aceh, it was found that many students still lack a proper understanding of physics concepts, as seen from the results of the question-and-answer tests on straight motion material. This condition can lead to confusion among students when tackling physics problems, which psychologically negatively impacts their thinking skills. Issues like this cause students to struggle to think clearly when solving physics problems, often resulting in comprehension difficulties during lessons. This is evident when students take exams; few are able to solve the problems given, with only one or two students able to answer. Students typically understand only the mathematical numbers involved and do not grasp the concepts presented in the questions. Furthermore, teachers still rely on standard textbooks and have yet to utilize teaching materials or learning media specifically designed to assist students in solving physics problems.

In solving physics problems, students should be able to understand the context of the questions by translating them into various representations so that physics concepts can be comprehensively understood. Therefore, it is essential to teach them how to solve problems using representations.

The ability to represent is crucial in physics education. Previous research has shown that representation skills are necessary for physics modeling, which supports students in understanding concepts. Concept representation through various models can enhance understanding according to the most appropriate and easily comprehensible representation. Additionally, representation skills support students in solving physics problems (J. Siswanto, 2019).

The Investigation Based Multiple Representation (IBMR) learning model can help develop students' abilities in cognitive, affective, and psychomotor domains (Oky Adi Yuliana, 2018). Furthermore, the IBMR learning model is developed as an intervention to enhance students' problem-solving skills. The IBMR learning model is supported by constructivist learning theory, which views learning as a process that students actively engage in to build knowledge based on personal experiences when interacting with other students or in groups. Based on previous research outlined earlier, it can be said that using multiple representations in physics learning allows students to better understand physics concepts comprehensively, facilitates problem-solving, and helps improve cognitive, affective, and psychomotor skills. However, the implementation of this research has been limited to using the IBMR model in learning and employing IBMR-based teaching tools. Meanwhile, educational materials such as modules and LKPD based on IBMR have yet to be developed.

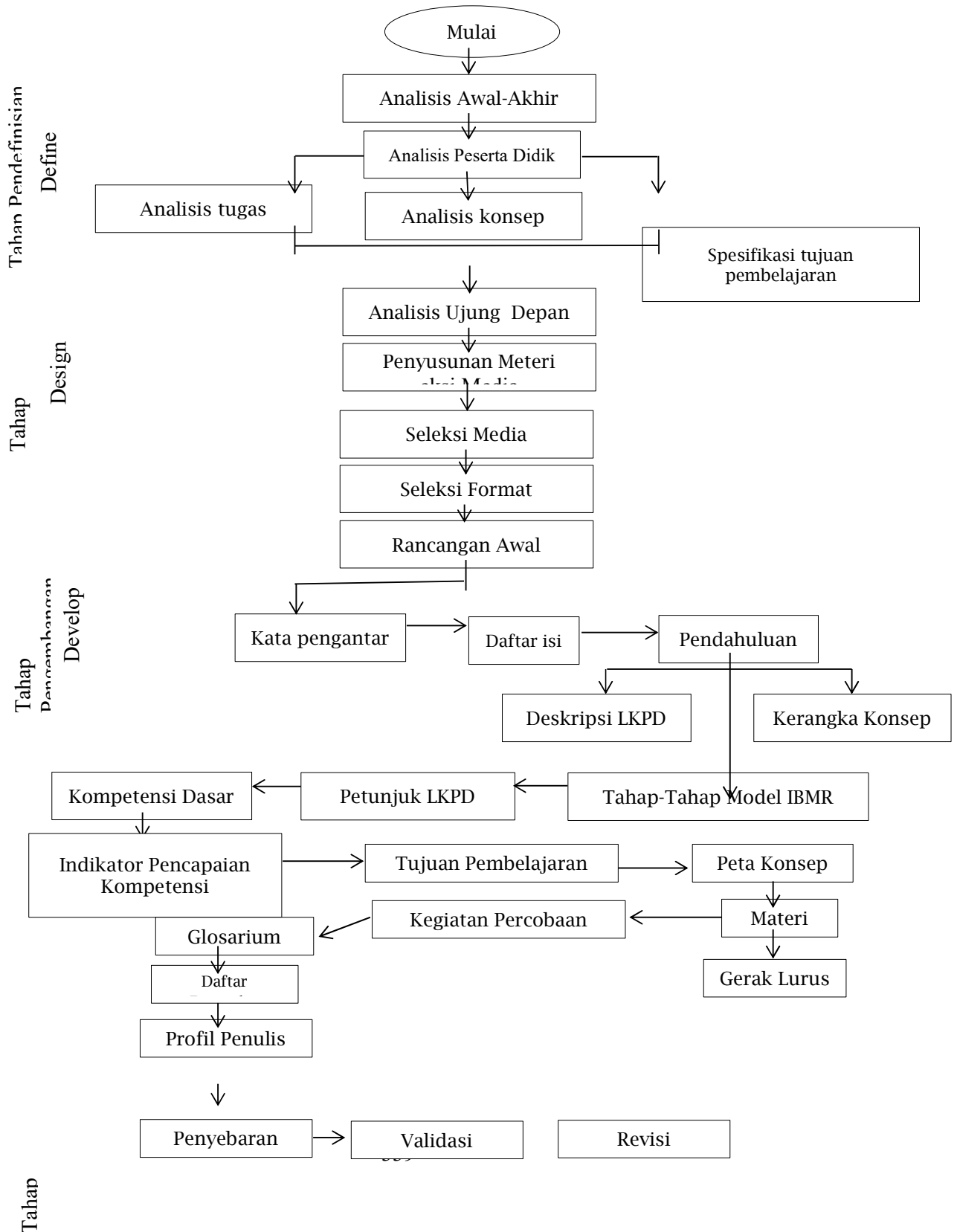
2. Research Methode

The research design implemented in this study uses the Research and Development (R&D) method, which focuses on uncovering patterns and their determinations through stages of change as a function of time. The research and development method is used to produce the effectiveness of the product (Sugiono, 2010). Research and Development (R&D) is a process or series of steps to develop a new product or improve an existing product, which can be accounted for. The research design employed in this study is the 4-D model development design (Four D Models). The 4D model consists of four main stages: the Define stage, the Design stage, the Develop stage, and the Disseminate stage.

The data collection techniques in this research utilize both qualitative and quantitative data. Qualitative data is obtained from expert and practitioner validation results in the form of critiques, suggestions, and comments for revising the IBMR model LKPD product.



Quantitative data is collected by asking written questions to be answered in writing by respondents.



Disseminate



Selesai

Gambar 1. Flowchart Pengembangan LKPD berbasis IBMR

Data validation analysis is conducted after the data is obtained from the validators. This data will then be analyzed qualitatively and used as a reference to revise the LKPD product results, ensuring that the developed output is feasible for use. The results that have been developed are assessed by validators using a validation sheet based on a Likert scale measurement. The feasibility assessment criteria consist of five criteria. The scoring criteria are as follows.

Tabel 1. Kriteria skor penilaian kelayakan

Kriteria Penilaian kelayakan	Skor
Sangat Layak	5
Layak	4
Cukup Layak	3
Kurang Layak	2
Sangat Kurang Layak	1

Untuk menghitung skor rata-rata dari hasil validasi digunakan persamaan sebagai berikut .

$$P = \frac{x}{xi} \times 100\%....$$

Keterangan :

P = Presentase setiap kriteria

x = Skor setiap kriteria

xi = Skor maksimum setiap kriteria

Hasil yang diperoleh dari rumus diatas akan dirujuk ke tabel kriteria kelayakan dibawa in.

Tabel 2. Kriteria Kelayakan

Kriteria Presentase Kelayakan	Tingkat Kelayakan
81% - 100%	Sangat layak
61% - 80%	Layak



41% - 60%	Cukup layak
21% - 40%	Kurang layak
< 21%	Sangat kurang layak

3. Result and Discussion

This research and development aims to design and produce Student Worksheets (LKPD) based on Investigation Based Multiple Representation for straight motion material suitable for use in learning by Grade X students at the SMA/MA level. This research and development is conducted using the 4-D model, which goes through four stages: Define, Design, Develop, and Disseminate.

3.1 Validation Data for IBMR-Based LKPD

The IBMR-based LKPD on straight motion was assessed by 6 validators, consisting of 2 content experts, 2 media experts, and 2 learning device experts. The validity assessment of the IBMR-based LKPD on straight motion was conducted by lecturers from the Tarbiyah and Teacher Training Faculty, Physics Education Study Program at UIN Ar-Raniry. The LKPD developed by the researcher and validated by the validators aims to facilitate students in understanding the learning material and instill in them the characteristics of independent thinking and learning.

Tabel 3. Data Pesentase Validator

No	Validator	Persentase (%)	Kriteria
1	Validator Ahli Media	74 %	Layak
2	Validator Ahli Materi	97,33 %	Sangat Layak
3	Validator Ahli Perangkat	89,35 %	Sangat Layak
Rata – rata skor total		93,57 %	Sangat Layak

3.2 Discussion

The student worksheet for physics learning based on IBMR (Investigation Based Multiple Representation) for straight motion material is designed in such a way that it achieves a suitable unity in terms of appearance and content. This research uses the 4D research type, and the aim of this study is to describe the design of the IBMR-based LKPD (Investigation Based Multiple Representation) for straight motion material and to describe the feasibility level of the IBMR-based LKPD on straight motion material.

To describe the feasibility level of the IBMR-based LKPD on straight motion material, the researcher provided the IBMR-based LKPD product to a team of expert lecturers. In this case, the product was given to two media experts, two content experts, and two learning device experts. The entire validation team consists of lecturers from the Physics Education Study Program, Tarbiyah and Teacher Training Faculty, UIN Ar-Raniry Banda Aceh. Based on the data obtained from the validation results, it is known that the IBMR-based LKPD on straight motion is suitable for use as one of the media.

The validators' assessment is indicated by scoring on a scale from one to five. The validation results for the media of the IBMR-based LKPD on straight motion obtained a score of 16 for the LKPD size aspect. Additionally, the cover design received a score of 54, and the design aspect of

the IBMR-based LKPD on straight motion received a score of 78. Thus, overall, the media assessment of the IBMR-based LKPD on straight motion received a total score of 148 with a percentage of 74%, categorized as feasible for use.

The validation results of the content/material on linear motion regarding the development of IBMR-based LKPD (Student Worksheets) on linear motion can be seen from several aspects assessed by the material validator expert team, providing scores on a scale from one to five. In the aspect of content feasibility, a score of 59 was obtained; in the aspect of material presentation components, a score of 39 was achieved; and in the linguistic aspect, a score of 48 was obtained. Thus, the total score obtained from the material validator expert team was 146, with a percentage of 97.33% based on the Likert scale calculation, categorized as very feasible for use.

The feasibility and validity of the IBMR-based learning tools, consisting of RPP (Lesson Plans) and LKPD, can be seen based on the assessment results from the validator expert team of learning tools. The assessment is indicated by scoring on a scale from one to five. The validation results of the learning tools from the validator's assessment received a score of 53 for the format aspect of RPP and LKPD, a score of 104 for the content aspect, a score of 53 for the language aspect, a score of 32 for the time aspect, and a score of 35 for the benefits of RPP and LKPD. Thus, the total score obtained from the assessment of the learning tool validator is 277, with a percentage of 89.35% and categorized as very feasible.

Conclusion

Based on the results and discussions outlined previously, it can be concluded that: The IBMR-based LKPD (Investigation Based Multiple Representation) design on linear motion is interesting and feasible for use, based on the validation results from media experts. The IBMR-based LKPD on linear motion for high school/Madrasah Aliyah is categorized as suitable for use as a learning media in the teaching and learning process, as evidenced by the average percentage categorized as feasible.

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