Efectiveness of Argumentation Flipped Learning (AFL) Assisted by Macromedia Flash Software to Improve Student's Understanding of Physics Concepts

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ABSTRACT
The objective of this research was to assess the validity, practicality, and effectiveness of enhancing students' comprehension of physics concepts. The research uses the Research and Development (R&D) method use ADDIE model. This research was conducted in Physics Education of Muhammadiyah Purworejo University with the research subjects of 4th semester students in a limited trial of 5 students and a broad trial of 8 students. The instruments used in this study were lesson plan validation sheet, media validation sheet, lesson plan implementation sheet, student activity sheet, physics concept understanding test sheet, scoring rubric, student response questionnaire, and notes on educational activities. Data evaluation techniques were quantitative, N-gain, and T-Test. The results of the study obtained (1) the validity of the application of the AFL model assisted by macromedia flash software was declared valid, (2) the practicality of the application of the AFL model assisted by macromedia flash software, as seen from the implementation of the lesson plan obtained an average of 3.72 in the good category and the reliability test was 93%, (3) the effectiveness of the application of the AFL model assisted by macromedia flash software, as seen from the results of increasing concept understanding obtained N-gain value of 0.68 which is included in the moderate category, response questionnaire with good category, and student activity with good category. It is concluded that the application of AFL model assisted by macromedia flash software is valid, practical, and effective.

INTRODUCTION

Understanding physics concepts is one of the main aspects that need to be considered in physics learning because it can affect student learning outcomes. Understanding the concept is the ability of students to internalize the subject matter by forming their own knowledge, so as to be able to re-

present it in a format that is simpler and easier to understand in its application [1]. Concept understanding is not just memorizing, but deepening understanding of the material presented. One of the effective methods to achieve concept understanding is to invite students to actively seek and find their own concepts [2]. This approach helps them gain a deeper understanding of physical phenomena in the context of their surrounding environment. Students will get direct experience, which will enrich their understanding, and allow them to accept, remember, and apply the concepts they have learned better. Research conducted by PISA shows that the literacy score in Indonesia is 382 with a rank of 64 out of 65 countries. [3].

Based on the situation in the field, students generally face difficulties in understanding physics material, especially during the Covid-19 pandemic which requires distance learning at home. This tendency starts from the experience of learning physics by involving aspects of complex concepts, understanding concepts, and solving complicated problems [4]. The covid 19 pandemic has an impact to date, especially on the education sector, which is shown by its impact on 1.58 billion children and adolescents in 200 countries including Indonesia [5]. The impact of Covid-19 is where all activities including learning activities are carried out online. This encourages researchers, to guarantee the ongoing provision of education utilizing online platforms and digital systems. Digital systems involve knowledge and skills as tools for online learning using digital platforms or digital environments [6]. The selection of the right system will provide support to educators through design of educational materials, digital instruments, and platforms that acquiring knowledge and skills process, active involvement and participation, and well-being of learners. Digital devices are one of the technological developments that can help users in two-way communication from a distance [7]. The use of digital devices must also be supported by the application of media as instructional design and platforms that support the learning process.

Advances in information and communication technology have produced various media and learning models that can be applied in teaching and learning activities [8]. This allows teachers to show greater creativity in learning and training approaches, with the aim of staying at the forefront of technological developments. Some technological developments For instance, utilizing devices like computers, electronics, and telecommunication systems to handle and disseminate information in a digital format. Computers play an important role in the development aspect of information technology advancement [9]. Many computer programs that can be applied in learning, one of which is Macromedia Flash. This media has the capability to display information in the form of text, images, and animations, so that students' interest in paying attention to physics learning becomes higher [10]. Furthermore, the physics learning approach through Macromedia Flash software has advantages in changing abstract material to be more concrete, changing the learning atmosphere that is less interesting to be more interesting, and reducing student boredom during the physics learning process. In addition, the use of learning media with Macromedia Flash provides motivation for students to develop creativity, gain valuable experience in the learning process, and contribute to improving physics learning outcomes [11].

Animations and visuals created using Flash maintain a high-quality appearance across various Windows sizes and screen resolutions. This attribute stems from Flash's utilization of vector graphic technology, allowing seamless resizing without compromising image quality. Moreover, Flash boasts faster loading times for animated images compared to other animation programs. It excels in swiftly generating intricate graphic animations, facilitating direct integration of full-screen animations into websites [12]. Employing Macromedia Flash as an educational tool proves advantageous for teachers, aiding in the preparation of teaching materials and structuring learning experiences. This media also engages students effectively, encouraging them to interact with and visualize abstract mathematical concepts [13]. This is in line with the opinion of Asrawati & Mulyati [14] which states that students' absorption of the material presented by the teacher can be maximized by using macromedia flash media.

Argumentation comes from Latin which describes presenting a view based on scientific evidence. This definition is also explained by Van Eemeren & Grootendorst [15] as a rational and social verbal act

formed from intellectual thought to persuade or criticise an opinion by presenting a series of propositions to prove or disprove a particular statement. The basis for improving the argumentation skills of physics students is the consideration that the method can gradually solve problems, is able to build socio-cultural interactions through presentation, criticism, and revision of an argument, facilitates and encourages students to be more courageous in expressing ideas because there is supporting evidence, and facilitates understanding of concepts and reasoning processes because students must find their own evidence that supports the claim [15]. Some of these points reflect the suitability of using argumentation in science learning because argumentation is needed to explain scientific principles and concepts and the relationship between them. The integration of argumentation in the learning process strengthens concept understanding and mastery of the subject matter [16].

Flipped learning originated as an innovative educational approach by a chemistry teacher in Colorado back in 2007. This teacher, who frequently stepped out of the classroom, recorded the teaching process, and shared it with students via YouTube before their in-class sessions [17]. Subsequently, students were instructed to preview the upcoming learning materials independently, using digital platforms or in-person interaction. This practice, often referred to as self-guided study or homework, takes place in the home environment. Hence, flipped learning represents a reversed instructional model, incorporating a mix of face-to-face and online elements, integrating collaborative learning and independent study [17].

Activities that are typically carried out in classrooms, such as content teaching, assignments, training and homework, are moved to a flipped learning model in an online format. In this approach, learners listen to explanations from educators and undergo exercises online, connected through technological devices, but in different physical locations. This approach signifies that the center of learning is on the students, and they are expected to have an active role in managing their learning independently.

Flipped learning is an upside-down learning approach. The characteristics of the flipped learning approach are that it reduces the direct involvement of educators in the learning process and increases the focus on students' independent learning through online access to materials. This approach has proven to be very suitable for implementation after the pandemic to compensate for the changes in learning during Covid-19. This method combines live interaction and online learning, combining group learning and self-learning [17]. The application of flipped learning is appropriate in online learning situations to overcome distance. Argumentation refers to the strategy of looking at a matter by putting forward strong assumptions and justifying them through the use of evidence in the form of facts. the application of the AFL model assisted by macromedia flash software was carried out to determine the effectiveness of the AFL model after the Covid-19 period on students' understanding of physics concepts.

METHOD

The research method used Research and Development (R&D) research method. This R&D research refers to the ADDIE The research approach employed in this study is the Research and Development (R&D) research method. This R&D research refers to the ADDIE development model with the following steps: Analyze, Design, Development, Implementation, Evaluation. The design of this research is a pre-experimental design with a one group pretest-posttest design combined with a one shot case study design. In this study, only one group was used without a comparison group. The subjects in this study were Physics Education students of Muhammadiyah Purworejo University in the fourth semester of the 2022/2023 academic year with a total of 8 respondents.

The research procedure is carried out by analyzing the material and analyzing the needs to obtain a problem which is then carried out the preparation of learning devices. Before the learning device is tested, it is validated first by two expert validators. Validation is carried out to obtain the validity of the device to be tested.

After the device is valid and suitable for use, a limited trial is conducted to obtain the practicality of learning media with the AFL model conducted by two observers during the learning process. Practicality is seen from the implementation of the lesson plan and its obstacles. The product was tested on a limited basis to obtain data that would be used to improve the instrument that had been applied and improvements would be made so that the product could be tested widely. Learning media with AFL model assisted by Macromedia Flash software was tested on a limited basis by taking 5 children from fourth semester students of Physics Education at Muhammadiyah Purworejo University. After the limited trial, feedback will be obtained regarding the learning media with the AFL model assisted by Macromedia Flash software developed.

The next stage is a broad trial to determine the effectiveness of learning media with AFL model assisted by Macromedia Flash software. This effectiveness is seen from the results of student response numbers, pre-test and post-test scores, and student activities observed by two observers. A development model with the following steps: Analyze, Design, Development, Implementation, Evaluation. The design of this research is a pre-experimental design with a one group pretest-posttest design combined with a one shot case study design. In this study, only one group was used without a comparison group. The subjects in this study were Physics Education students of Muhammadiyah Purworejo University in the fourth semester of the 2022/2023 academic year with a total of 8 respondents.

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RESULTS AND DISCUSSIONS

The results of learning media research with AFL model assisted by Macromedia Flash software are in the form of validation, practicality, and effectiveness. Validation was carried out by two expert validators to determine the validity of the instruments used. The feasibility of learning media with the AFL model which was tested on a limited basis to identify the applicability the form of the AFL model to practicality of learning media with the AFL model. After being tested on a limited basis, it was then applied to the broad trial stage. This stage aims to determine the effectiveness of learning media with AFL model assisted by Macromedia Flash software.

Validation is carried out to obtain the validity of the applied product. The results of media validation are shown in table 1.

Table 1. Media Validation Results

No	Assessed Aspect	Score		Average Score	Reliability
		Expert Lecturer 1	Expert Lecturer 2		
1	Design and Display	19	17	18	94%
2	Balance	8	7	7.5	93%
Total Actual Score		**27**	**24**	**25.6**	**94%**

The results of validation by the two expert validators, the design and display aspects obtained a score of 18 so as to obtain a percentage of 90% with a value of 3.60 in the good category. The balance aspect obtained a score of 7.5 so that it obtained a percentage of 93.75% with a value of 3.75 with a good category, so that the overall aspect received a score of 12.75 so that the average was 3.68 with a good category. The results of the media expert assessment if presented in a bar chart can be seen in Figure 1.
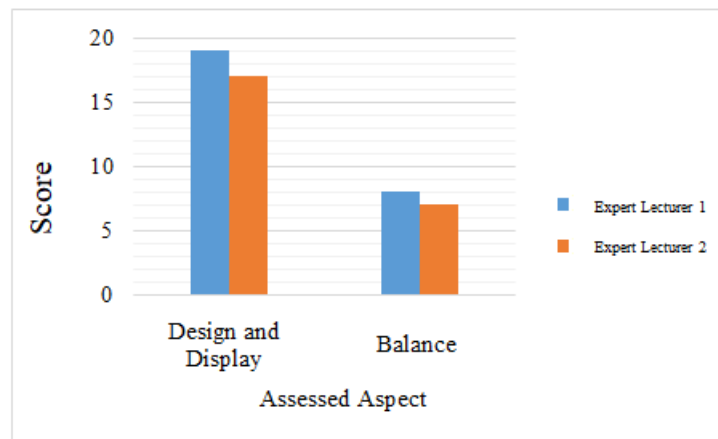
Fig 1. Media Validation Results

The reliability test on the design and appearance aspect is 94%. The balance aspect is 93%. The reliability obtained from all aspects assessed for learning media with AFL model assisted by Macromedia Flash software is 94% with reliable category. The results of the reliability test if presented in a bar chart can be seen in Figure 2.
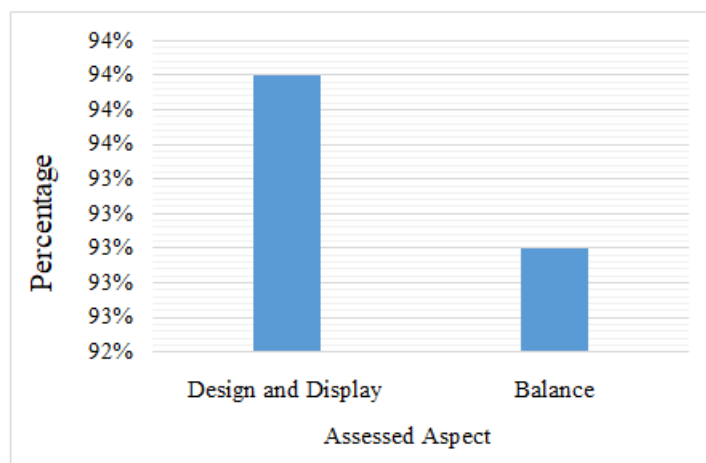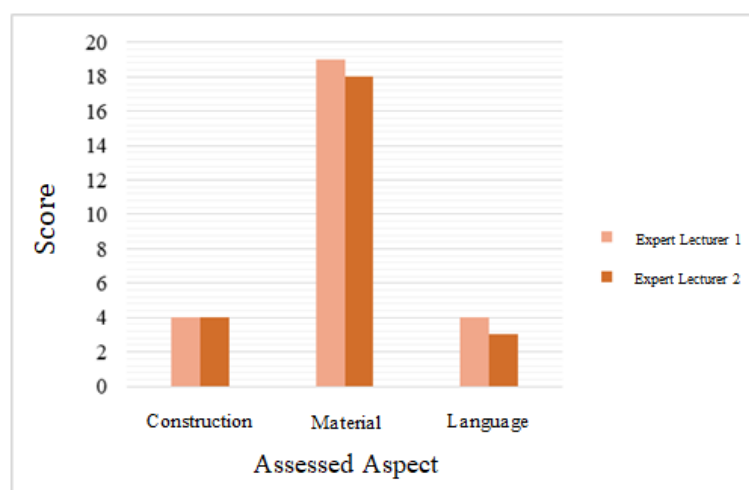

Fig 2. Reliability Test Results

The outcomes of the validation for the lesson plan are displayed within Table 2.

Table 2. Result of lesson plan validation

No	Assessed Aspect	Score		Average Score	Reliability
		Expert Lecturer 1	Expert Lecturer 2		
1	Construction	4	4	4	100%
2	Material	19	18	18.5	97%
3	Linguistics	4	3	3.5	86%
Total Actual Score		**27**	**25**	**26**	**96%**

The results of validation by two expert lecturers, the construction aspect obtained a score of 4 so that it obtained a percentage of 100% with a value of 4 with a good category. The material aspect obtained a score of 18.5 so that it obtained a percentage of 92.5% with a value of 3.70 with a good category. The language aspect obtained a score of 3.5 so that it obtained a percentage of 87.5% with a value of 3.50 with a fairly good category. So that all aspects get a score of 8.7 so that the average is 3.73 in the good category. The results of the media expert assessment if presented in a bar chart can be seen in Figure 3.

Fig 3. RPP Validation Results

The reliability test on the construction aspect is 100%. The material aspect is 97%. The linguistic aspect is 86%. The reliability obtained from all aspects assessed for the application of the AFL model assisted by macromedia flash software is 96% with a reliable category. The results of the reliability test if presented in a bar chart can be seen in Figure 4.
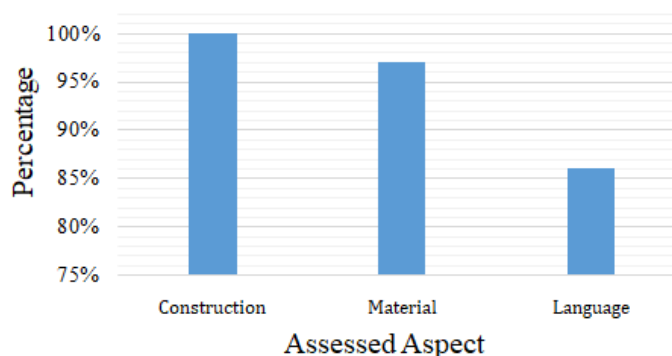
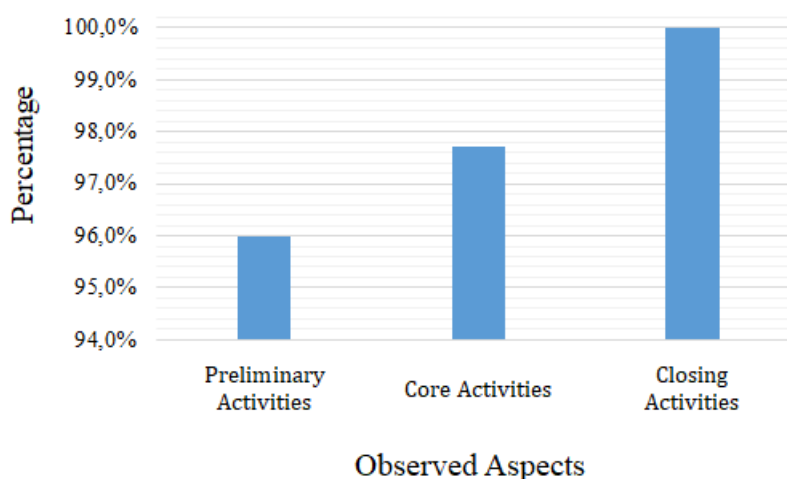*Fig 4. RPP Reliability Test Results*

The practicality of learning media with AFL model assisted by Macromedia Flash software is obtained from the data on the results of the implementation of the lesson plan obtained from the learning implementation instrument which is observed by two observers during the learning process. Practicality is carried out on a limited trial to obtain effectiveness criteria. The results of the lesson plan implementation are presented in Table 3.

Table 3. Results of lesson plan implementation

No	Assessed Aspect	Score 1	Score 2	Average Score	Percentage
1	Introduction Activity	26	24	25	89.3%
2	Core Activities	22	21	21.5	89.6%
3	Closing Activities	8	8	8	100%
Average Actual Score				**18.50**	**93%**

The results of observations by two observers, the aspect of preliminary activities obtained a score of 25 with a value of 3.57 so as to obtain a percentage of 89.3% in the good category. The aspect of this activity obtained a score of 21.5 so as to obtain a percentage of 89.6% with a value of 3.58 with a good category. The closing activity aspect obtained a score of 8 so that it obtained a percentage of 100% with a value of 4 with a good category, so that the overall aspect received a score of 18.50 so that the average was 3.72 with a good category.

Reliability test on the aspect of introductory activities amounted to 89.3%. The aspect of core activities amounted to 89.6%. The aspect of closing activities amounted to 100%. The reliability obtained from all aspects assessed for the implementation of the lesson plan with the AFL model assisted by Macromedia Flash software is 93% with the reliable category. The results of the reliability test if presented in a bar chart can be seen in Figure 5.

Fig 5. Reliability test results of lesson plan implementation

The efficacy of educational tools employing the AFL model is evident through student feedback, pre-test and post-test performance, and student engagement. The feedback provided by the students obtained an average value of 3.9 with a percentage of 89.6% so that it was in the good category. The results of the student pre-test obtained an average value of 65.5 and the average value of the post-test was 88.9. So that the N-gain criterion is 0.68 with a moderate category because the N-gain value is included in the normalized gain criteria. This shows that after carrying out learning activities students experience an increase in concept understanding ability in Table 5.

Table 5. N-gain results of pre-test and post-test questions

Semester	Material	Average		N-gain
		Pre-Test	Post-Test	
4	Impulse and Momentum	65.5	88.9	0.68

The results of observations by two observers, the listening aspect obtained a score of 4 with a value of 4 so that it obtained a percentage of 100% in the good category. The aspect of proposing obtained a score of 3.5 with a value of 3.5 so as to obtain a percentage of 87.5% with a fairly good category. The aspect of cooperation obtained a score of 3.5 with a value of 3.5 so as to obtain a percentage of 87.5% with a fairly good category. The aspect of understanding obtained a score of 3 with a value of 3 so that it obtained a percentage of 75% with a fairly good category. The discussion aspect obtained a score of 3.5 with a value of 3.5 so that it obtained a percentage of 87.5% with a fairly good category. The respect aspect obtained a score of 4 with a value of 4 so that it obtained a percentage of 100% in the good category. The aspect of relevant behavior obtained a score of 3 with a value of 3 so that it obtained a percentage of 75% with a fairly good category. So that all aspects get an average score of 3.5 with a value of 3.5 in the good enough category.

CONCLUSION AND SUGGESTION

Based on the results of research on Learning Media Development with AFL Model Assisted by Macromedia Flash Software is valid, practical, and effective, so that learning media with AFL model is feasible to be applied to improve the understanding of student physics concepts. The conclusion is based on several things (1) Learning media with AFL model assisted by Macromedia Flash software that is applied is valid. (2) Learning media with AFL model assisted by Macromedia Flash software applied is practical in limited trials. The results of the practicality of the application of the AFL model from the analysis of learning implementation obtained an average of 3.72 in the good category. (3) Learning media with AFL model assisted by Macromedia Flash software applied is effective seen from the ability to understand the concept of physics students have increased, this is shown from the N-gain pre-test and post-test of 0.68 which is included in the medium category, students respond well during the learning process, and students do good activities during the learning process.

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