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Interactive Multimedia Design Based on Cognitive Conflict on Dynamic Fluid Using Adobe Animate CC 2019

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ABSTRACT

In the 21st century Science and Technology (IPTEK) is experiencing very rapid development which requires students to have skills in that century. In addition, one of the objectives of learning physics in the 2013 curriculum is to have a good understanding of concepts and principles. However, in reality there are still obstacles in students' understanding of concepts that are still low, including dynamic fluid material. The solution given is to develop interactive multimedia based on cognitive conflict. This study aims to determine the characteristics of interactive multimedia design and determine its validity. This type of research is development research using the Plomp development model which is special to the preliminary research and prototyping stages to the *expert review*. Preliminary research data obtained from needs analysis through filling out a questionnaire by 3 physics teachers and the validity of the data obtained from 3 physics lecturers. The instruments in this study were teacher questionnaires, self-evaluation sheets and expert validity sheets. Data were analyzed descriptively. This research produces interactive multimedia with characteristics set according to 4 syntaxes of cognitive conflict-based learning models using the adobe animate cc 2019 application. Multimedia is designed to improve students' conceptual understanding of dynamic fluid materials and justify 4C skills. the results of self-evaluation show that multimedia is in the very good category.

Keywords: misconception, adobe animate cc 2019, dynamic fluid, cognitive conflict, interactive multimedia

INTRODUCTION

In the 21st century, education is very demanding to be more effective and relevant, not only in the field of science but also in other fields of science. IUPAC *(International Union of Pure and Applied Physics)* explains that physics is the necessary basic knowledge that will become the driving engine for future technological developments. Therefore, according to Suari (2017) physics is very important to learn.

Difficulty understanding physics concepts, especially concepts that already exist in students' minds which are obtained from paying attention to the natural surroundings or reading books that have many conceptual errors in them. Physics is a science that studies the phenomena of objects found in nature (Suari, 2017). According to Harefa (2019) in essence, humans need knowledge and keep abreast of technological developments in order to live this life in harmony. The development of technology is a manifestation of physics which is studied by experts who are experts in their field. Physics has many benefits, including physics plays a major role in the discovery of technologies, through physical science can reveal the secrets of nature, physics has contributed to the development of other sciences. This can be used as a basis for training students' conceptual understanding of physics learning material.

Understanding of concepts is very important in learning physics according to Puspita sari, Mufit & Asrizal (2021) because with mastery of concepts, the knowledge possessed by students can last a long time even though the material has been taught for a long time. Associated with students' conception of the material has long been taught. Misconceptions in students will hinder the process of receiving new knowledge that is trying to be constructed through learning so that it hinders students in the learning process.

The problem of misconception and low conceptual understanding is a problem happens a lot in physics learning. Misconceptions can be interpreted as usage concept that does not correspond to that concept stated by scientists or experts who scientifically accepted (Pratama, Anggraini, yusri & Mufit 2021). Misconceptions in

learning physics are students' misunderstandings in understanding the concepts of physics material. The occurrence of misconceptions to students in learning will result in hampering the acceptance of new knowledge concepts that are trying to be built through classroom learning, especially in physics learning (Alfiani, 2015).

Based on this, various efforts have been made by teachers and the government to support the learning process so that it runs optimally. However, students' understanding of the concept of dynamic fluid material currently not in accordance with what is expected. This can be seen from the results of preliminary research that has been carried out using a questionnaire instrument given to 3 physics teachers at SMA N 1 Kuantan Mudik. The questionnaire given aims to analyze the implementation of learning on dynamic fluid materials at SMA N 1 Kuantan Mudik and some problems were found.

Table 1. Implementation of Dynamic Fluid Learning at SMA N 1 Kuantan Mudik Problem

Problem Indicator	Percentage (%)
Emphasizing on memorizing physics formulas/equations	73
Emphasizing on experimental/experimental activities in finding concepts	53
Discuss more about the matter of calculation	80
IT-based learning media to support learning is not available	93
Emphasize the discussion of questions	80
Use of IT-based teaching materials	40

Based on Table 1 it can be concluded that in physics learning, teachers emphasize memorization Physics formulas/equations that are quite frequent and only emphasize experimentation/experimental activities in finding concepts, are smaller than memorizing formulas. This can cause students' conceptual understanding of dynamic fluid material to be low. The use of IT-based teaching materials is still very low.

The solution to overcome the problems found in dynamic fluid materials is to use interactive multimedia teaching materials grounded cognitive conflict using Adobe Animate CC 2019 Ramdania (2019). And this is also in accordance with research conducted by Fadhilah and Hanum (2019) which states that cognitive conflict-based worksheets are practical to use. Arranged based on the syntax of *the cognitive conflict* according to Mufit (2018), with four syntaxes namely is: activation of preconceptions and misconceptions, presentation of cognitive conflicts, earning of concepts and similarities and reflection. Cognitive conflict-based learning models have a positive impact on increasing understanding of concepts and at the same time can remediate students' misconceptions (Rahim, 2015). Therefore, the aim of this research is to produce valid cognitive conflict-based interactive multimedia to improve students' understanding of 4C concepts and skills on dynamic fluid material.

METHOD

This type of research is *Development Research* or also called *Design Research research),* experiments / experiments in finding concepts More discussing and providing questions about counting IT-based learning media to support online learning are not available Emphasis is one research model to develop and validate the product so that it is fit for use. Furthermore, the model used in this study is the Ploom model. This research procedure consists of 3 stages, namely the preliminary research stage, the development/prototyping stage and the assessment stage. However, in this study only up to the development/prototyping stage.

The needs analysis was carried out in 2 ways, namely literature study and giving questionnaires to 3 physics teachers at SMA N 1 Kuantan Mudik. The literature study was conducted by analyzing 4. Journals to determine the percentage of misconceptions that occur in dynamic fluid materials. Grouped into 3 understanding concepts, namely not understanding, misconceptions and understanding concepts.

The development stage is carried out by self evaluation carried out by the researchers themselves in order to perfect the product or interactive multimedia that has been made before being submitted by the head of the validator. Self assessment of the product

using the percentage technique as follows (Retnawati, 2016).

$$\% = \frac{skoryangdiperoleh}{skortotal} x100\%$$

Validity data analysis the product obtained from the checklist sheet obtained from the validity sheet checklist data compiled using a Likert scale. (Retnawati, 2016).

Table 2. Likert scale

Likert Scale	Evaluation
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

Then the validity value is analyzed using Aiken's V validity index

$$V = \frac{\sum s}{n(c-1)}$$

Remarks:
V = Rater agreement index
l_0 = The lowest practicality rating score (l_0 = 1)
c = The highest practicality rating score (c = 5)
r = Number share by an appraiser
n = number of rater

RESULTS AND DISCUSSION

The development stage was carried out with *Self* research stage *preliminary* reviewed four journals related to students' misconceptions on dynamic fluid material. The four journals were analyzed using descriptive analysis aimed as a guide in developing a product (Plomp, 2013) and the following results were obtained.

Table 3. Identification of the evaluation journal

Journal Identification	Concept Understanding	Analysis Result
Journal1	Miconception	65,32%
	Not really understand	13,06%
	Lucky/lack of confidence	6,76%
	Understand the concept	14,86%
Journal 2	Miconception	29,21 %
	Do not Understand the concept	7,06%
	Understand the concept	22,86%
	Partially understand	34,92%
	Cannot be coded	5,93%
Jornal 3	Understand the concept	6%
	Partially understand	35%
	Miconception	28%
	Do not understand the concept	30%
Journal 4	Misconception	29,21%
	Do not Understand the concept	7,09%
	Understand the concept	22,86%
	Cannot be coded	5,93%

Based on table 3 misconceptions on dynamic fluid material is still higher than understanding the concept. The following are the results of a questionnaire given to physics teachers at SMA N 1 Kuantan Mudik to determine the implementation of dynamic fluid learning.

Table 4. Percentage of Dynamic Fluid Learning Implementation at SMA N 1 Kuantan Mudik.

Problem Indicator	Percentage (%)
Emphasizing on memorizing physics formulas/equations	73
Emphasizing on experimental/experimental activities in finding concepts	53
Discuss more about the matter of calculation	80
IT-based learning media to support learning is not available	93
Emphasize the discussion of questions	80
Use of IT-based teaching materials	40

Based on Table 4 it can be concluded that during the implementation of dynamic fluid learning, teachers still use direct learning models in explaining the material or are teacher-centered. This situation is in accordance with research conducted by Mufit *et al* (2020) which said that the lack of understanding of student concepts among the causes was that the learning carried out was still teacher-centered. Learning that should emphasize student activity seems to have disappeared because it is only fixated on the material conveyed by the teacher conventionally (lectures) which is a method in the form of interaction through explanations and verbal narratives by the teacher to students (Jafar, 2021). In giving questions, the teacher more often gives a matter of calculation rather than a matter of concept. Development Phase (Prototyping Phase) Interactive multimedia design.

The design stage aims to design interactive multimedia use the Adobe animate CC 2019 application. Interactive multimedia is designed by applying the Cognitive Conflict-Based Learning (PBKK) consisting of 4 syntaxes, namely: preconceptions activities, presentation of cognitive conflicts, discovery of concepts and similarities, reflection (Mufit & Fauzan, 2019). The interactive multimedia designed according to the Minister National Education (2008) contains titles, learning instructions, competencies to be attained, proponent information, action steps, training assignments and evaluations. Figure 1 shows students' prior knowledge before learning begins. This activity is important because it will be a reference for educators in providing appropriate actions during learning. This stage is equipped with questions and pictures supporting the material that will reveal students' preconceptions and misconceptions.

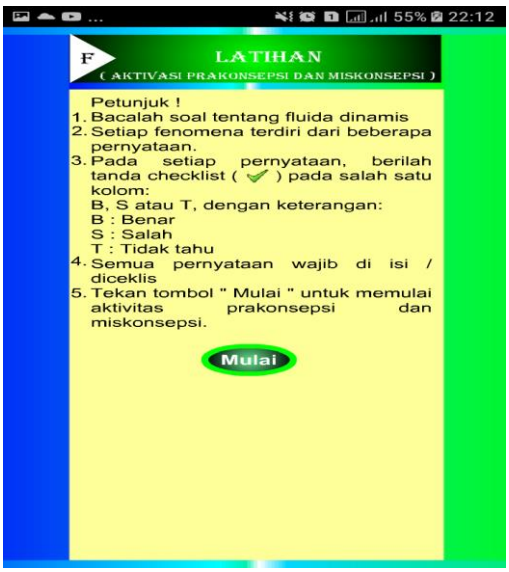

Figure 1. Preconception and Misconception Stage

One the next page, several questions will be provided with correct, incorrect, and don't know answer choices. As in a figure 2 below:

Figure 2. Examples of preconceptions and misconceptions.

Figure 3 and figure 4 is the display of the second stage, namely the presentation *of cognitive conflict*. This stage contains phenomena that occur in everyday life whose purpose is to create *cognitive conflicts* in the minds of students. The presentation of cognitive conflict at this stage is equipped with related questions and pictures so that students do not experience difficulties in researching the given phenomenon. This stage is also assisted by worksheet containing questions. Students provide temporary answers to trigger cognitive conflict and curiosity.

Figure 3. Cognitive Conflict Presentation Stages.

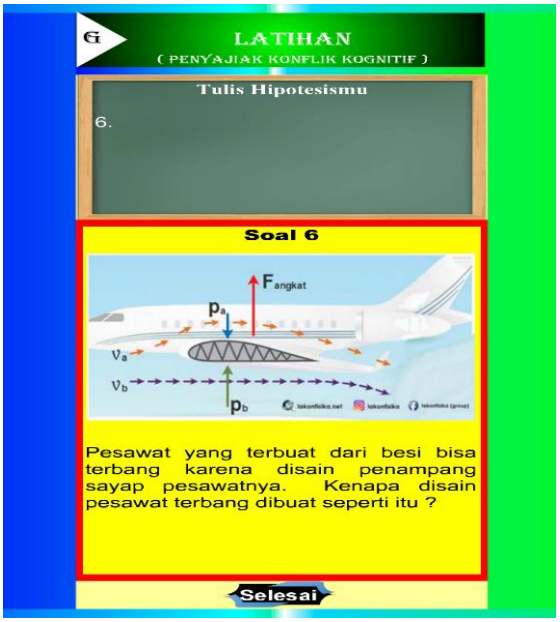

Figure 4. Example of Problems at the Stage of Presenting Cognitive Conflict

The third stage is the stage of finding concepts and equations. This stage aims to create and achieve conceptual understanding that lasts in students' memories. This stage also aims for students to be able to distinguish between physics equations and physics concepts. These results are consistent with previous research which states that the appearance of teaching materials will make users interested in using them (Annisa, Mufit & Asrizal 2020).

At this stage students also use a *virtual laboratory* to find concepts and equations that can be directly opened in interactive multimedia applications that which can be seen in figure 5 and figure 6.

Figure 5. Display of Concepts and Concept Discovery

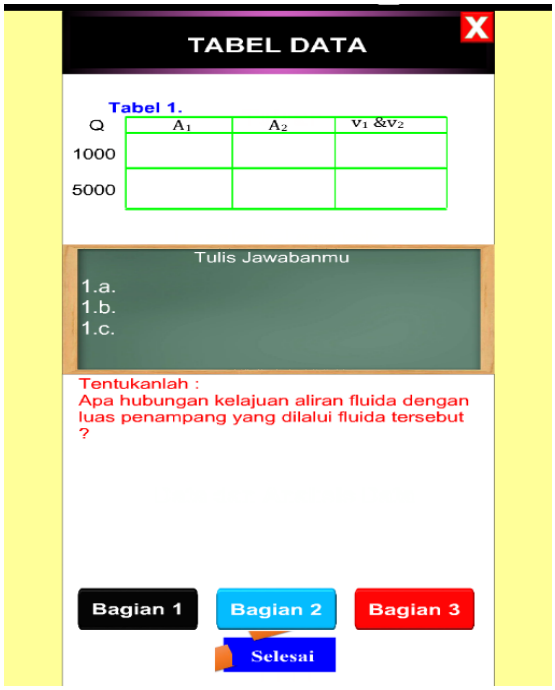

Figure 6. Display of Examples of Concept Finding Stages

The last stage is the reflection stage which aims to make educators can assess the level of understanding of students' concepts after going through the stage of finding concepts and equations which can be seen in Figure 7.

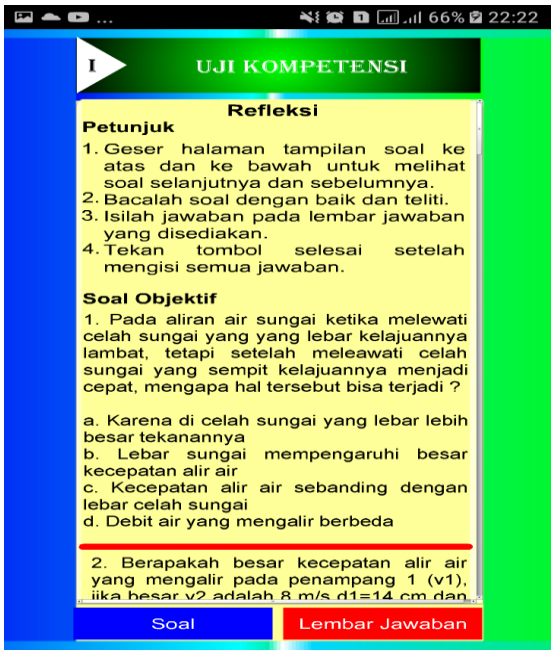

Figure 7. Reflection Stage

Self-Evaluation

evaluation stage or *self-evaluation* is carried out by the researchers themselves after the researchers designed interactive multimedia. The self-assessment aims to see the initial mistakes that arise from the beginning of interactive multimedia design. The following are the results of the self

evaluation for each component of the assessment, which can be seen in figure 8.

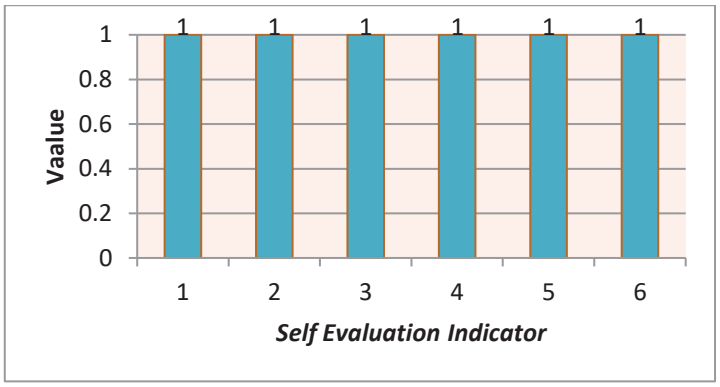

Figure 8. Self-Evaluation Results

Expert Reviews

At this stage interactive multimedia is validated by experts using a validation assessment instrument that has been developed by Muhammad Dhanil, the previous researcher, then interactive multimedia validation is carried out by 3 experts who is a physics lecturer at the Faculty of Mathematics and Natural Sciences, UNP. The average validation results instrument validation carried out by previous researchers were in the range of 0.92 and 1, with the average validation results of the assessment instrument being 0.97 and were in the valid category.

The assessment instrument that had been developed previously was then used to validate the interactive multimedia that the researcher developed. The multimedia assessment instrument used consists of 4 assessment components, namely (1) material substance, (2) learning design (3) *visual communication display,* (4) software usage (national, 2010). The following are the results of validation for each component of the assessment can be seen in Figure 9:

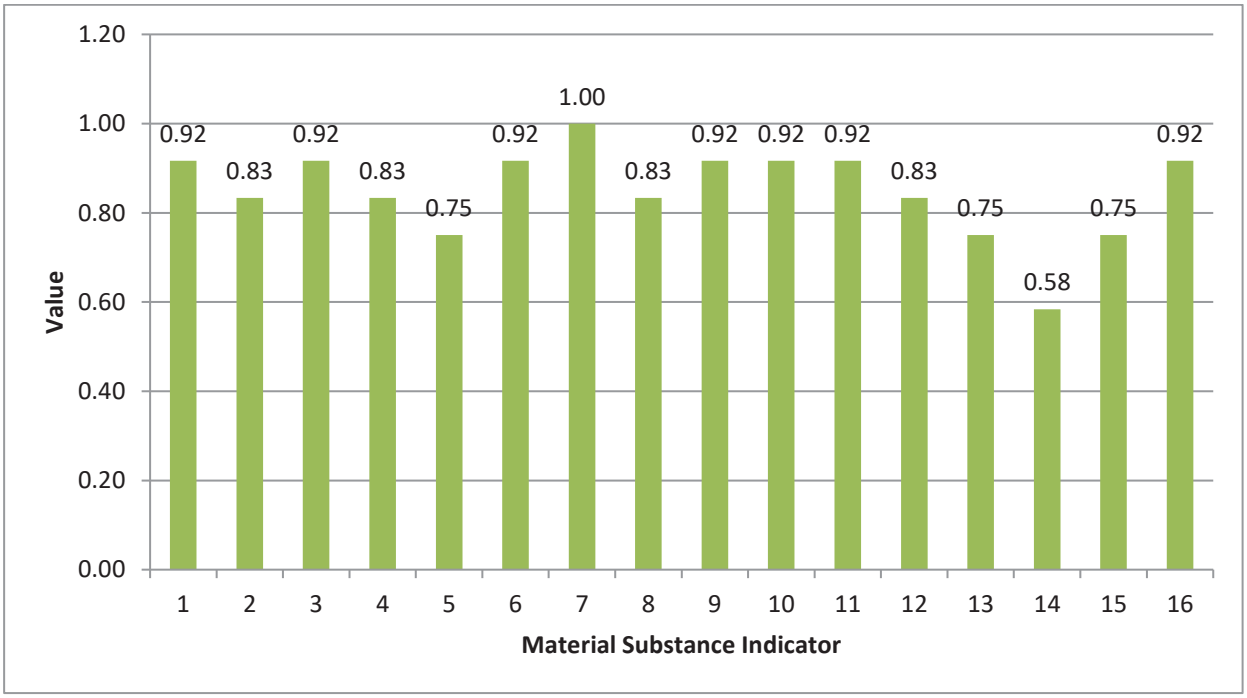

Figure 9. Results of Validation of Material

Based on the picture above, it is concluded that the value of the material substance indicator is in the range of 0.58 to 1.00 of the 16 indicators assessed, there are 12 indicators classified as very strong, which is in the range of 0 .83 to 1.00 and indicators of moderate value from the range of 0.58 to 0.75 as many as 4 indicators and are in the valid range. Thus the validation value for the substance of the material and interactive multimedia is very valid can be seen in Figure 10.

Second element is a learning design divided into 20 indexes with the following results:

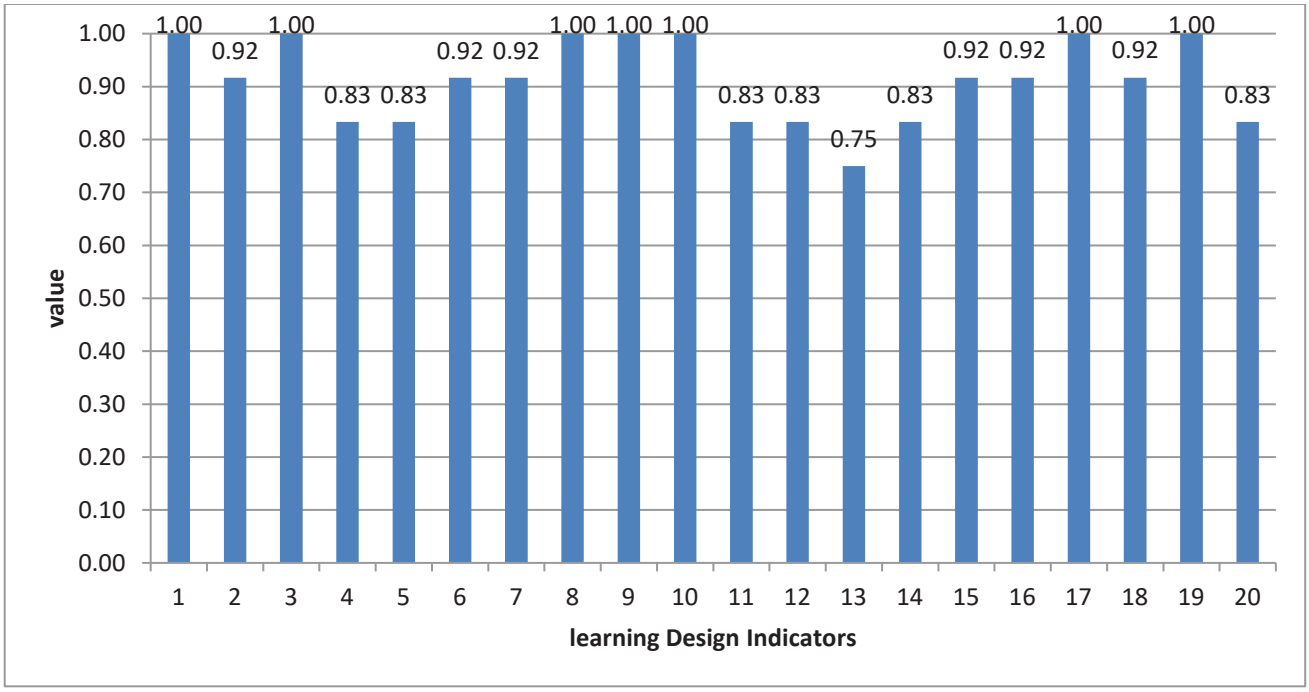

Figure 10. Learning Design Validation Results

Build upon on Figure 10, it is concluded that the value of the learning design validation index ranges from 0.75 to 1.00. Of the 20 indicato rs that were assessed, there were 19 very strong indicators, ranging from 0.83 to 1.00 and indicators classified as being at a value of 0.75. The average validation value on the instructional design indicators is 0.91 thus the value of the learning design validation is classified as very valid.

The third element is visual communication display which consists of 8 assessment indicators with the results as shown in Figure 11.

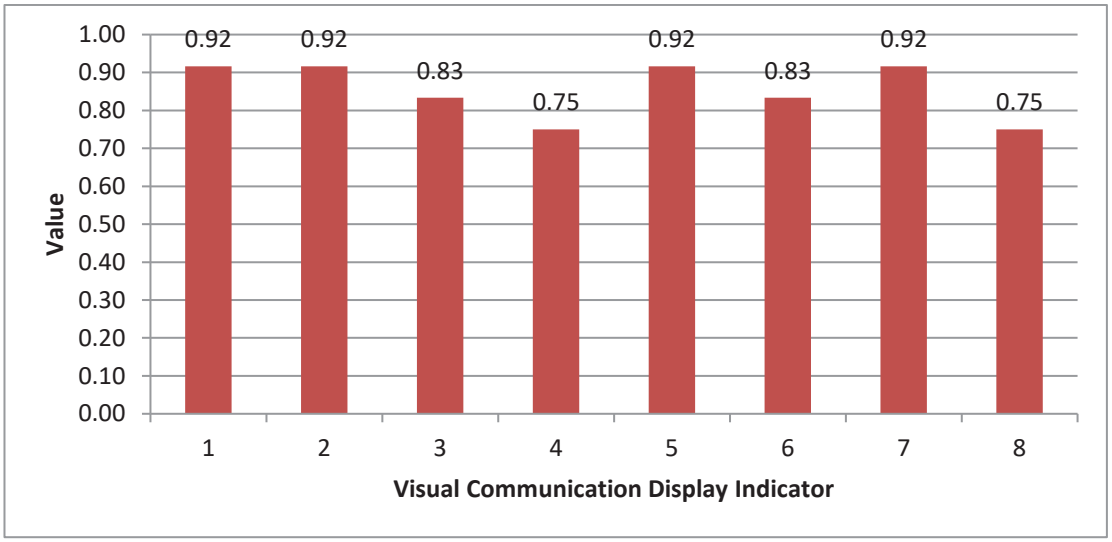

Figure 11. Validation of the Visual

Figure 11, is the indicator value on the visual communication display distance about 0.75 until 0.92. There are 6 indicators that are classified as strong indicators ranging from 0.83 to 0.92. The indicator is classified as being at 0.75. The average validation value on the visual communication display indicator is 0.85 and is classified as very valid.

The fourth component is use of software which consists of 3 assessments as shown in Figure 12.

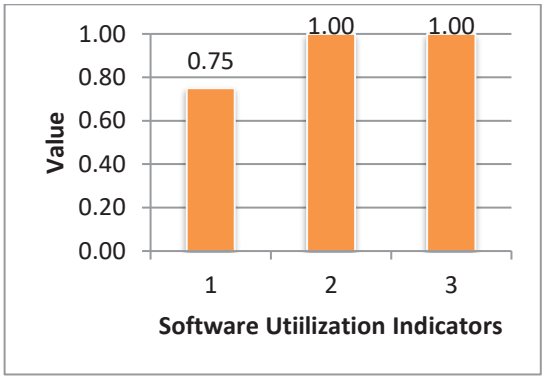

Figure 12. Results of Validation of Software Utilization

communication display *visual* around 0.83. The three indicators are classified as very valid with an average of 0.83.

Based on the validation evaluation, the average analysis result for each interactive multimedia component can be seen in Figure 13.

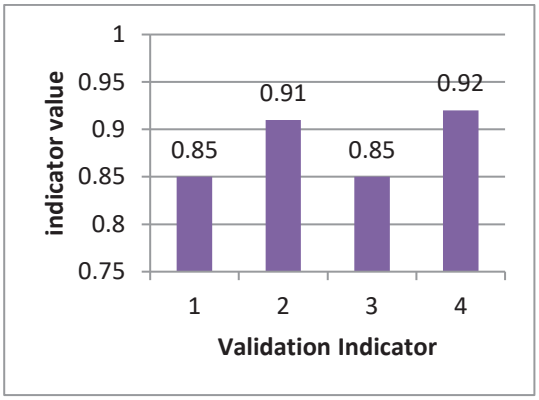

Figure 13. Average Expert Review Validation Results

According Figure 13 it can be concluded that validation indicator values include 0.85, 0.91, 0.85, 0 ,92. This value can be concluded that the overall indicators on interactive multimedia are very valid.

Based on preliminary research, the percentage of misconceptions in dynamic fluid materials is still quite high. The result of distributing questionnai res to teachers is to find out how the implementation of learning in SMA N 1 Kuantan Mudik which is still teacher-centered by 73% and still emphasizes memorizing formulas.

The development phase (Development/Prototyping Phase) begins with interactive multimedia design. Applying a cognitive conflict-based learning model using adobe animate cc 2019. After the design is complete, the next stage is self-evaluation with interactive multimedia results in the valid category.

The next assessment is an expert review carried out by 3 validators, namely a physics lecturer at FMIPA UNP who is an expert in their field. The validation results from this expert review stage obtained the level of validity in the valid category.

Interactive multimedia already contains 4 syntaxes of cognitive conflict-based learning models, namely the presentation of the preconception and misconception activation stages, the presentation of cognitive conflicts, the discovery of concepts and similarities as well as reflection. Which has been developed properly and correctly.

The results *of the validity of interactive multimedia* based *cognitive conflict* are in the very valid and usable category (Arifin, Mufit & Asrizal, 2021). Research conducted by Yuli & Mufit (2021) stated that *cognitive conflict* has the highest result in increasing conceptual understanding and can remediate students' misconceptions.

CONCLUSION

Interactive multimedia has been designed to improve students' understanding and 4C concepts and skills. Interactive multimedia was designed assign the Adobe Animate CC 2019 application and contains four syntaxes of cognitive conflict-based learning models, namely activation of preconceptions and misconceptions, presentation of cognitive conflicts, discovery of concepts and similarities, reflection. Interactive multimedia is valid in aspects, material substance, learning design, visual communication display, software utilization. Researchers can test cognitive conflict-based interactive multimedia for its practicality and effectiveness for future researchers. Can be used as an alternative teaching material in improving the understanding of 4C concepts and skills in dynamic fluids.

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