EDUCATUM – Journal of Social Science (EJOSS), Vol.8 No.1 2022
ISSN 2289-9391 / eISSN 2462-2443 (13-22)

The Validity of Interactive Multimedia Based on Cognitive Conflict on Elasticity Materials Using Adobe Animate CC 2019

Sonia Fitri Anggraini[1], Fatni Mufit[2]*, Gusnedi[2] , Letmi Dwiridal[2]

[1]Study Programof Physics Education, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Padang, 25131, INDONESIA
[2]Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Padang, 25131, INDONESIA
*e-mail: fatni_mufit@fmipa.unp.ac.id

Published: 29 June 2022

To cite this article (APA): Anggraini, S. F., & Mufit, F. (2022). The Validity of Interactive Multimedia Based on Cognitive Conflict on Elasticity Materials Using Adobe Animate CC 2019. *EDUCATUM Journal of Social Sciences, 8*(1), 13-22. https://doi.org/10.37134/ejoss.vol8.1.2.2022

To link to this article: https://doi.org/10.37134/ejoss.vol8.1.2.2022

Abstract

Low concept understanding and misconceptions often occur in physics learning, including concepts on elasticity. On the other hand, there are not many available IT-based teaching materials that support 21st century online learning that can improve understanding of concepts. Therefore, it is important to develop interesting IT-based teaching materials that can improve understanding of concepts and remediate students' misconceptions. This study aims to produce valid cognitive conflict-based interactive multimedia. This type of research is development/design research using the Plomp model. This article reports the results of the development phase, namely prototype design, self evaluation and expert review. The instrument collects data using a self-evaluation sheet and a validation sheet. The validity data were analyzed using the V-Aiken formula.Based on the results of the preliminary research, interactive multimedia has been designed with the following characteristics: composed of 4 syntaxes of cognitive conflict models, namely 1) activation of preconceptions and misconceptions, 2) presentation of cognitive conflicts, 3) discovery of concepts and similarities and 4) reflection. In the third syntax, a virtual laboratory on elasticity experiments is integrated. Multimedia was developed using the Adobe animate cc 2019 application to support interactivity between students as users and multimedia. The results of self-evaluation obtained a score of 1.00 with very valid criteria. The results of the validity test through expert review obtained a score of 0.79 with valid criteria. Interactive multimedia based on cognitive conflict has been valid in terms of material substance, learning design, visual communication display and software utilization. The interactive multimedia prototype can then be tested for practicality and effectiveness. The development of interactive multimedia based on cognitive conflict of elasticity material has implications for increasing conceptual understanding and supporting 21st century learning.

Keywords Interactive Multimedia, Cognitive Conflict, Misconception, Elasticity, Adobe Animate CC 2019

INTRODUCTION

Quality human resources can be realized through education. Indonesian education is currently implementing education with the 2013 Curriculum. In the 2013 curriculum, learning is student-centered (Permendikbud, 2018). One of the goals is for students to adapt to 21st century learning by having 4C skills (communication, collaboration, critical thinking, and creativity) and understanding technology. Through communication skills, students can convey their ideas, both orally and in writing. Collaboration skills train students to be skilled in collaborating with several people or groups to achieve certain goals. Critical thinking trains students to solve a problem by finding the right solution. Creative thinking skills train students to be able to find various perceptions, concepts, ideas, ways to solve problems, conflicts and develop and convey new things to others (Zakaria, N., Mat, N., Baharum, H., & Sintian, M, 2016). Learning activities are needed that can train students' 21st century skills.

One of the objectives of learning physics according to the 2013 Curriculum is for students to understand concepts and principles and have skills in developing knowledge and higher self-confidence and can develop science and technology (Permendikbud, 2014). Based on these objectives, learning physics must be a means and a vehicle for mastering existing knowledge, concepts and principles. One of the demands of teachers in realizing the goals of the 2013 curriculum is that teachers are required to develop interesting, creative and innovative teaching materials (Zuriah, N., Sunaryo, H., & Yusuf, N, 2016). In supporting physics learning, teachers can develop interesting teaching materials and at the same time are designed to improve understanding of concepts.

But in reality, in physics learning there are still many misconceptions and students' low understanding of concepts. Misconceptions and misconceptions do not only occur in low-ability students, but also occur in high-ability students (Nachiappan, S., Rengasamy, K., Maniam, V., Ganaprakasam, C., & Zulkafaly, F. M, 2016). This happens because of the discrepancy between the students' knowledge that they get from everyday experience with the correct knowledge according to the experts (Daud, N. S. N., Abd Karim, M. M., Hassan, S. W. N. W., & Rahman, N. A, 2015). As research shows that 81% of students find it difficult to solve physics problems even though they feel they understand the topic of the problem, and as many as 47% of students feel that physics equations do not support their understanding of concepts, because physics equations are only needed to answer questions without understanding the meaning. physically (Mufit & Fauzan, 2019). The problem of misconception is also found in the concept of elasticity. One of the physics concepts that are closely related to everyday life is the concept of elasticity and Hooke's law. Hidayati's research results show that there is a misconception about the concept of plastic-elastic energy as much as 49.64%, Hooke's law concept as much as 38.09% and the concept of Young's modulus 63.75% (Hidayati, 2016). The thing that causes misconceptions is that the learning model is still dominant in lectures or conventional learning. By using this model students cannot find new ideas or ideas from learning, because learning is only teacher-centered.

In preliminary research activities conducted at SMAN 13 Padang regarding problems in physics learning activities, especially on elasticity material, it was found that learning activities were still carried out conventionally with the teacher-centered lecture method. Physics learning which is dominated by lectures and does not involve students in concept discovery can be one of the reasons for the lack of understanding of concepts and causes of misconceptions in students (Mufit, F., Asrizal, Hanum, S. A., & Fadhilah, A, 2020). Other problems encountered from preliminary research are, there is still minimal use of IT-based teaching materials that support online learning, there are no available media or teaching materials that can specifically improve students' understanding of concepts. In addition, learning activities are still lacking in training students' 4C skills so that students' 4C skills are still low.

One solution to overcome the problems mentioned above is to develop interactive multimedia teaching materials based on cognitive conflict. IT-based teaching materials are important in the current technological era, as a learning support tool and information delivery medium (Depdiknas, 2010). Interesting teaching materials can trigger students' attention and creative ideas so that learning can be student-centered (Widada, 2017). Conflict-based teaching materials are arranged according to the syntax of the cognitive conflict-based learning model (CCBL Model). The CCBL model is designed to improve conceptual understanding and remediate students' misconceptions in learning science and mathematics (Mufit & Fauzan, 2019). The CCBL model consists of four syntaxes, namely 1) activation of preconceptions and misconceptions, 2) presentation of cognitive conflicts, 3) discovery of concepts and similarities, and reflection, which can improve understanding of concepts and remediate misconceptions of high school students and college students (Mufit, et.al, 2018; Annisa, et.al, 2020).

Teaching materials in the form of interactive multimedia can support 21st century online learning. These teaching materials use a cognitive conflict-based learning model to improve students' understanding of concepts. Previous research has developed cognitive conflict-based teaching materials in the form of student worksheets and there is no interactivity aspect in teaching materials (Mufit, F., Asrizal, Hanum, S. A., & Fadhilah, A, 2020). Furthermore, IT-based teaching materials have also been developed, including in the form of e-modules using the Flipbook Maker application (Pratama, V.,

Anggraini, S. F., Yusri, H., & Mufit, F, 2021), and teaching materials in the form of interactive multimedia using the Macromedia Flash application (Arifin, F. A., & Mufit, F, 2021). However, the e-module and interactive multimedia teaching materials are still lacking in terms of student interactivity as users with multimedia. This study develops multimedia using the Adobe Animate CC 2019 application which is better in supporting user interactivity with multimedia. This application can be used on students' smartphones offline. Cognitive conflict-based interactive multimedia using the Adobe Animte CC application is designed to improve conceptual understanding and train students' 21st century skills.

The development of teaching materials in the form of interactive multimedia strongly supports online learning and blended learning in the 21st century. Interactive multimedia is a form of teaching material which contains attractive images, videos, and animations so that they can convey messages to students (Imansari, N., & Surnayantiningsih, I, 2017). Interactivity in multimedia can be an attraction for students to learn, students can choose a menu, choose an answer or get feedback directly on multimedia. Cognitive conflict-based interactive multimedia can train students' 4C skills, both in offline and online learning. Multimedia is ideal for use in learning both inside and outside school (Nais, M. K., & Siswani, E. D, 2018). Many software can be used to create interactive multimedia, one of them is the Adobe Animate CC 2019 software. The advantage of making interactive multimedia using adobe animate cc 2019 is that it can support multimedia interactivity by users. The adobe animate cc 2019 application is also easy to use wherever and whenever offline on student smartphones, thus saving on the use of internet credit (Abdullah, F. S., & Yunianta, T. N. H, 2018).

Interactive multimedia based on cognitive conflict encourages students to think critically, collaboratively, think creatively and communicatively in finding concepts. The nature of this interactive multimedia allows students to type answers according to their own thoughts, then can carry out practicals using a virtual laboratory and can find their own concepts. And students also get feedback from the answers given. Therefore, it is urgent to develop interactive multimedia based on cognitive conflict, especially on elasticity material, in supporting offline and online learning. The purpose of this research is to design interactive multimedia based on cognitive conflict that can improve students' understanding of 4C concepts and skills on elasticity and Hooke's law, and know the validity.

METHODS

The type of research used is development research (Development Research), using the Plomp development model. Plomp states that development research is needed to design and develop an intervention as a solution to educational problems (Plomp, 2013). This article reports the results of development research in the form of prototype design, self evaluation and validity testing through expert review. Development research using the Plomp model in this study can be seen in the Tessmer diagram in Figure 1.

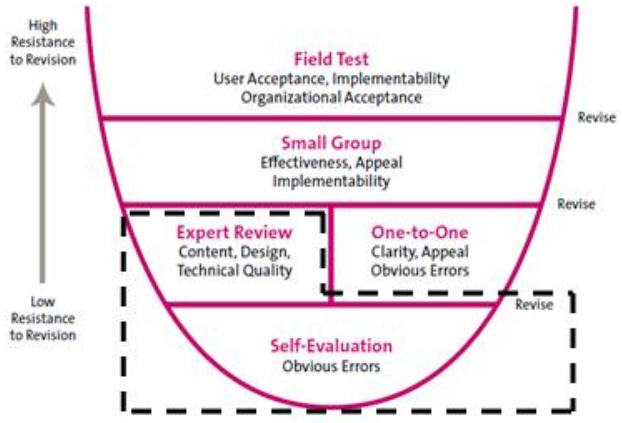

Figure 1: Formative Evaluation (Tessmer, 1993, in Plomp, 2013).

The development stage (development/design research) aims to design products in the form of interactive multimedia that can be used via smartphones so that students can easily apply them. At this stage, it begins with a self-evaluation by researchers to see the shortcomings of interactive multimedia based on cognitive conflict before being assessed by experts. Furthermore, interactive multimedia based on cognitive conflict was validated by experts (expert review) consisting of 3 physics lecturers. The indicators contained in the validation instrument are compiled based on ICT-based teaching material guidelines, which consist of: material substance, learning design, visual communication display and software utilization. The four indicators were developed into several questions that were adapted to the characteristics of the multimedia prototype. The self-evaluation sheet instrument and the expert review validation sheet were compiled using a Likert scale, with categories, namely: a) a score of 5 (strongly agree), b) a score of 4 (agree), c) a score of 3 (neutral), d) a score of 4 (disagree).), e) score 5 (strongly disagree). Self evaluation and expert review data were analyzed using the following equation:

$$Score = \frac{Obtained\ Score}{Maximum\ Score}\ X\ 100\%$$

Furthermore, the validity data were analyzed using the Aiken's V formula as follows.

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

Description:

$$s\ = r - l_0$$

V = rater deal index
l_0 = The lowest practicality rating score (in this case = 1)
c = The highest practicality rating score (in this case = 5)
r = Number given by an evaluator
n = Number of raters

After obtaining the rater agreement index, the category of the index can be decided with the Aiken's V index as follows.

Table 1: Aiken's V Index

Interval	Category
$\leq 0{,}4$	Less Valid
$0{,}4 < V \leq 0{,}8$	Valid
$0{,}8 < V$	Very Valid

If the results of the product assessment are in the less valid category, then revisions are made according to the validator's suggestions, so that multimedia products are obtained that are in the valid or very valid category.

RESULTS AND DISCUSSION

Based on the problems obtained at the preliminary research stage, at the development stage, an interactive multimedia prototype based on cognitive conflict was designed. Interactive multimedia is structured based on four syntaxes of cognitive conflict-based learning models consisting of four stages, namely 1) activation of preconceptions and misconceptions, 2) presentation of cognitive conflicts, 3) discovery of concepts and similarities, and 4) reflection. Each syntax has the potential to improve students' understanding of concepts. The first syntax aims to find out the misconceptions that exist in students which are obtained from the results of students' answers to questions that discuss everyday problems. The second syntax aims to develop students' creative thinking skills, at this stage students can express their own ideas and thoughts. The third syntax aims to discover concepts and equations of

students independently through multimedia that integrates a virtual laboratory. And the fourth syntax aims to find out the understanding that students just got from the multimedia used whether students already understand or are still experiencing misconceptions (Mufit, F. & Fauzan, A., 2019). Interactive multimedia was created using the Adobe animate cc 2019 application so that it is interactive and can be used on student smartphones. The interactive multimedia prototype based on cognitive conflict can be seen in Figure 2.

(a) (b) (c)

Figure 2: (a) Cover, (b) Activation stage of preconceptions and misconceptions and (c) Presentation of cognitive conflicts.

Figure 2(a) is the cover which is part of the main page containing the title, identity, class, and semester. The title of this interactive multimedia is "Interactive Multimedia Based on Cognitive Conflict to Improve Students' Understanding of 4C Concepts and Skills on Elasticity and Hooke's Law Materials". Figures 2(b) and 2(c) are the first and second syntax displays of the cognitive conflict-based learning model, namely the preconception and misconception activation stages and the cognitive conflict presentation stage. The pre-conception and misconception activation stage aims to determine the understanding of students' initial concepts or misconceptions about elasticity. At this stage, questions are given about the concept of elastic-plastic, the concept of Hooke's law, the concept of a series-parallel spring, and the concept of the potential energy of a spring. At the stage of presenting cognitive conflict, physics phenomena about elasticity are presented which are contrary to students' thoughts and often become misconceptions for students. In the second syntax, students write hypotheses about the given elasticity phenomenon. The next stage in the syntax of the cognitive conflict-based learning model is the concept and equation discovery stage. At this stage, a virtual laboratory about elasticity and Hooke's law is integrated so that students can find the concept of equations independently through the virtual laboratory. And the last stage is reflection, which serves to retrain students' conceptual understanding on elasticity material. The design for this stage is as follows.

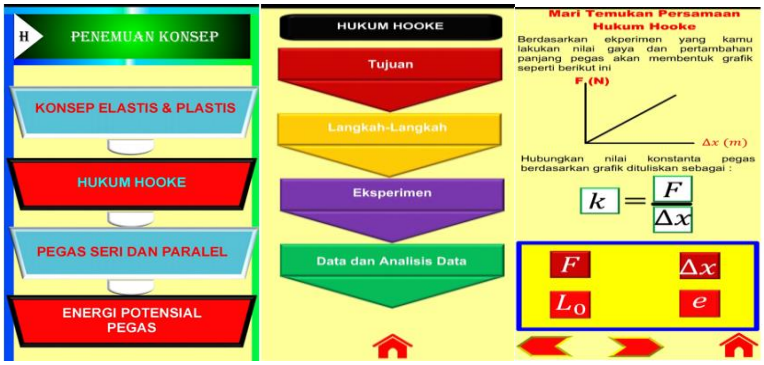

Figure 3: Concept and Equation Discovery Design.

Figure 4: Reflection Design.

Figure 3 is a design for finding concepts and equations, at this stage students are guided to be able to find concepts and equations through virtual/virtual laboratory experimental activities with the topic of Hooke's law which is directly linked to the web phet.colorado.edu. Figure 4 is a reflection stage that aims to re-examine the hypotheses that have been made at the stage of presenting cognitive conflicts and answering questions that are already available to see students' understanding abilities. In this reflection stage, students get feedback in the form of scores obtained from answering the reflection questions that have been provided. In each CCBL syntax model can train students' 4C skills including critical thinking skills trained in the first syntax, namely at the preconception and misconception activation stage, creative thinking skills can be trained in the second stage, namely the stage of presenting cognitive conflict, collaboration skills can be trained in the third stage, namely the discovery of concepts and similarities and communicative skills can be trained through the fourth stage, namely reflection.

The next stage is self-assessment or self-evaluation. Self-evaluation was carried out by the researcher himself in order to re-examine the interactive multimedia based on cognitive conflict that had been made. There are six indicators on self-evaluation, namely the interactive multimedia structure in accordance with the guidelines for developing ICT-based teaching materials, interactive multimedia in accordance with the CCBL model syntax, interactive multimedia already integrating virtual laboratories, language, display, and software utilization. The results of self-evaluation obtained results from the six indicators, namely a value of 1 with a very valid category.

The next stage is an exeprt review which is a product assessment by 3 experts who are physics lecturers at the Faculty of Mathematics and Natural Sciences, UNP. This assessment aims to validate interactive multimedia products. The instrument used in product validation has 4 indicators, including: material substance, learning design, visual communication display, and software utilization. The results of interactive multimedia validation on indicators of material substance can be seen in Table 2 below.

Table 2: Interactive Multimedia Expert Review Results on Material Substance Indicators

Material Substance Indicator	Value	Category
The material presented in interactive multimedia (MI) is in accordance with the Basic Competencies (KD).	0.92	Very Valid
The substance of the material presented is correct and complete.	0.75	Valid
The physics equations presented are correct.	0.83	Very Valid
The physical symbols used are correct.	0.92	Very Valid
The physics term used is correct.	0.92	Very Valid
The physics concept presented is correct.	0.83	Very Valid

The images, videos and animations presented are in accordance with the material.	0.83	Very Valid
The material presented in interactive multimedia is in accordance with the development of science.	0.67	Valid
Sentence writing in MI is in accordance with good and correct Indonesian rules.	0.75	Valid
The language used in MI can be clearly understood.	0.75	Valid
Average Material Substance Indicator	0.82	Very Valid

Based on Table 2, there are ten components of the material substance indicator which are assessed by experts as being in the valid and very valid categories. So that the average of each component in the material substance indicator is 0.82 which is in the very valid category. Furthermore, the results of interactive multimedia expert reviews on learning design indicators can be seen in Table 3 below.

Table 3: Interactive Multimedia Expert Review Results on Learning Design Indicators

Learning Design Indicators	**Value**	**Category**
The title presented in MI is in accordance with the material.	0.83	Very Valid
The formulation of Core Competencies (KI) in MI is in accordance with the Content Standards.	0.92	Very Valid
The KD formulation in MI is in accordance with the Content Standards.	0.92	Very Valid
The indicators presented in MI are in accordance with KD.	0.92	Very Valid
The learning objectives in MI are in accordance with the indicators.	1.00	Very Valid
MI already contains the syntax of the cognitive conflict-based learning model appropriately.	0.75	Valid
The presentation of the preconception and misconception activation stages in interactive multimedia can reveal students' initial knowledge.	0.67	Valid
The presentation of the cognitive conflict presentation stage in interactive multimedia can trigger students to think deeply.	0.58	Valid
The presentation of the stage of finding concepts and equations in teaching materials can lead students to find concepts and similarities.	0.58	Valid
The presentation of the reflection stage on teaching materials can reveal the progress of students' understanding.	0.75	Valid
The integration of the Virtual laboratory in MI is appropriate in achieving the indicators.	0.83	Very Valid
The material presented in MI is in accordance with the learning objectives.	0.83	Very Valid
Sample questions in MI are appropriate for the achievement of learning indicators.	0.75	Valid
Practice questions/tests/simulations in MI are suitable for achieving learning indicators.	0.92	Very Valid
MI facilitates the process of creative thinking (creativity thinking) to create basic ideas/concepts for students.	0.75	Valid
MI facilitates communication in expressing oral and written ideas for students	0.67	Valid
MI facilitates collaboration between students.	0.58	Valid
MI facilitates critical thinking processes for students.	0.58	Valid
The identity of the compiler in MI is correct.	0.75	Valid
Every reference in MI is listed in the Bibliography.	0.75	Valid
Average Learning Design Indicators	0.77	Valid

Based on Table 3, it can be seen that there are 20 components in the learning design indicators which include interactive multimedia assessments that integrate cognitive conflict-based learning models and apply 4C skills. Of the 20 assessment components on this indicator, the results of each component are in the valid and very valid category. So that the average assessment on this learning design indicator is

0.77 which is in the valid category. Furthermore, the assessment of the visual communication display indicators can be seen in Table 4 below.

Table 4: Interactive Multimedia Expert Review Results on Visual Communication Display Indicators

Visual Communication Display Indicator	Value	Category
Using basic navigation and hyperlinks on MI is working fine.	0.92	Very Valid
The use of fonts (type and size) of letters in MI is proportional.	0.83	Very Valid
Images, videos, sounds, and animations that are presented on MI already work well.	0.83	Very Valid
The color combination on the cover and each MI slide is proportional.	0.75	Valid
The animations used in MI don't slow down the slideshow.	0.83	Very Valid
The cover display on the MI shows the contents.	0.75	Valid
Layout and layout on MI is proportional and attractive.	0.83	Very Valid
Instructions for using MI are precise and clear.	0.75	Valid
Average Visual Communication Display Indicator	0.81	Very Valid

Based on Table 4, there are eight components of the visual communication display indicators that are assessed by experts as being in the valid and very valid categories. So that the average of each component on the visual communication display indicator is 0.81 which is in the very valid category. Furthermore, the results of interactive multimedia expert reviews on software utilization indicators can be seen in Table 5 below.

Table 5: Interactive Multimedia Expert Review Results on Software Utilization Indicators

Software Utilization Indicator	Value	Category
MI is interactive in providing feedback to users.	0.75	Valid
MI uses supporting software.	0.75	Valid
MI is an original work.	0.75	Valid
Average Software Utilization Indicator	0.75	Valid

Based on Table 5, there are three components in the indicators of software utilization assessed by experts, including MI can provide feedback, use supporting software and are original works that are in the valid and very valid categories. So that the average of each component in the material utilization indicator is 0.75 which is in the valid category. From each result obtained at the expert review stage for each indicator, the average for the four indicators is 0.79, which means that interactive multimedia based on cognitive conflict is valid. The results of this validity are in accordance with Delvia's research which developed teaching materials based on cognitive conflict on atomic core material (Delvia, T. F., Mufit, F., & Bustari, M, 2021), with the results of research that these teaching materials are very valid. In the third stage of the CCBL model on teaching materials, integrated virtual laboratory on atomic nuclei. Likewise with the results of interactive multimedia research based on cognitive conflict developed on direct current electric material (Luthfi, I., Mufit, F., & Putri, M. R. N, 2021), it was found that multimedia was also valid. In the concept of style, a valid e-module based on cognitive conflict was also developed in terms of content, appearance, language and construct (Pratama, V., Anggraini, S. F., Yusri, H., & Mufit, F, 2021). The development of interactive multimedia based on cognitive conflict was also found to be valid and practical on thermodynamics and wave mechanics (Arifin, F. A., & Mufit, F, 2021). From several previous studies, there are similarities with this research, namely using a cognitive conflict-based learning model with four syntaxes in it, and both produce teaching materials that integrate a virtual laboratory. The advantage of the current study compared to previous research is that it is in the interactive part. In the current study, the multimedia produced can be used by students on their respective cellphones without the need for an internet network in use, except in the third stage of the discovery of concepts and equations. Interactive is meant that there is a reciprocal relationship between multimedia and its users (students). Users can pour their own thoughts on the multimedia, then users can also find the right answer if there are previous doubts from interactive multimedia.

CONCLUSION

Based on the results of the research that has been done, interactive multimedia has been designed with characteristics that contain four syntaxes of cognitive conflict-based learning models, including 1) activation of preconceptions and misconceptions, 2) presentation of cognitive conflicts, 3) discovery of concepts and similarities, 4) reflection. In the third stage, this syntax integrates a virtual laboratory to find concepts and equations. Interactive multimedia uses the Adobe Animate CC 2019 application which is very good at supporting the user interactivity process with Multimedia. The result of this interactive multimedia self evaluation is 1.00 which is classified as very valid. And the product validity results obtained from the experts at the expert review stage were 0.79 which was classified as valid. Interactive multimedia based on cognitive conflict on elasticity material has been valid in terms of material substance, learning design, visual communication display and software utilization. Interactive multimedia can then be tested for its practicality and effectiveness in improving concept understanding. This interactive multimedia is useful in increasing students' understanding of concepts in 21st century learning, both for offline learning and blended learning.

REFERENCES

Abdullah, F. S., & Yunianta, T. N. H. (2018). Pengembangan media pembelajaran matematika trigo fun berbasis game edukasi menggunakan adobe animate pada materi trigonometri. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *7*(3), 434-443.

Annisa F, Mufit F dan Asrizal, 2020 Analisis Validitas dan Praktitikalitas Lembar Kerja Siswa Berbasi Konflik Kognitif pada Materi Gerak Lurus dan Gerak Parabola *Pillar Phys. Educ.* **13**, 1 hal. 233–240.

Arifin, F. A., & Mufit, F. (2021, April). Validity and practicality of interactive multimedia based on cognitive conflict integrated new literacy on thermodynamic and mechanical waves material for class xi high school students. In *Journal of Physics: Conference Series* (Vol. 1876, No. 1, p. 012052). IOP Publishing.

Daud, N. S. N., Abd Karim, M. M., Hassan, S. W. N. W., & Rahman, N. A. (2015). Misconception and Difficulties in Introductory Physics Among High School and University Students: An Overview in Mechanics (34-47). *EDUCATUM Journal of Science, Mathematics and Technology*, *2*(1), 34-47.

Delvia, T. F., Mufit, F., & Bustari, M. (2021). Design and Validity of Physics Teaching Materials Based on Cognitive Conflict Integrated Virtual Laboratory in Atomic Nucleus. *PILLAR OF PHYSICS EDUCATION*, *14*(1), 05-14.

Depdiknas, 2010 *Panduan Pengembangan Bahan Ajar Berbasis TIK* Jakarta: Dikjen Pendidikan Dasar dan Menengah.

Hidayati, Fika Nurul. "Identifikasi miskonsepsi siswa kelas X pada materi elastisitas dan hukum hooke di SMA Negeri 1 Indralaya." *Jurnal inovasi dan pembelajaran fisika* 3, no. 2 (2016).

Imansari, N., & Surnayantiningsih, I. 2017. Pengaruh Penggunaan E-Modul Interaktif Terhadap Hasil Belajar Mahasiswa Pada Materi Kesehatan Dan Keselamatan Kerja. VOLT*: Jurnal Ilmiah Pendidikan Teknik Elektro*, 2(1), 11-16

Luthfi, I., Mufit, F., & Putri, M. R. N. (2021). Design of Physical Teaching Materials Based on Cognitive Conflict Learning in Direct Current Electricity Integrating Virtual Laboratory. *Pillar of Physics Education*, *13*(4).

Mufit F Festiyed F Fauzan A dan Lufri L, 2018 Impact of Learning Model Based on Cognitive Conflict toward Student's Conceptual Understanding *IOP Conf. Ser. Mater. Sci. Eng.* **335**, 1.

Mufit, F. (2019). Pengembangan LKS berbasis konflik kognitif terintegrasi literasi baru pada materi fluida untuk siswa kelas XI SMA. *Pillar of Physics Education*, *12*(4).

Mufit, F. & Fauzan, A. 2019. *Model Pembelajaran Berbasis Konflik Kognitif (PbKK).* Malang: CV. IRDH.

Mufit, F., & Fauzan, A. (2019, October). The application of real experiments video analysis in the CCBL model to remediate the misconceptions about motion's concept. In *Journal of Physics: Conference Series* (Vol. 1317, No. 1, p. 012156). IOP Publishing.

Mufit, F., Asrizal, Hanum, S. A., & Fadhilah, A. (2020). Preliminary Research In The Development Of Physics Teaching Materials That Integrate New Literacy And Disaster Literacy. *Journal of Physics: Conference Series*, *1481*(1). .

Nais, M. K., & Siswani, E. D. (2018). Multimedia of Chemistry Enrichment in Colloidal Systems for Vocational High School Students. *EDUCATUM Journal of Science, Mathematics and Technology*, *5*(1), 24-30.

Permendikbud. (2014). Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 59 Tahun 2014 Tentang Kurikulum 2013 Sekolah Menegah Atas/Madrasah Aliyah.

Nachiappan, S., Rengasamy, K., Maniam, V., Ganaprakasam, C., & Zulkafaly, F. M. (2016). Analysing Mathematics Teaching Towards Cognitive Application in Primary School Standard Curriculam Through Hermeneutics Method. *EDUCATUM Journal of Social Sciences*, *2*(1), 31-41.

Permendikbud. (2018). Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 36 Tahun 2018 Tentang Perubahan Atas Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 59 Tahun 2014 Tentang Kurikulum 2013 Sekolah Menegah Atas/Madrasah Aliyah.

Plomp, Tjeerd. 2013. Educational Design Research: An Introduction". Dalam T. Plomp & N. Nieveen (Ed). Educational Design Research, Part A: An Introduction. Netherlands Institute For Curricullum Development: Netherlands Institute For Curricullum Development.

Pratama, V., Anggraini, S. F., Yusri, H., & Mufit, F. (2021). Disain dan Validitas E-Modul Interaktif Berbasis Konflik Kognitif untuk Remediasi Miskonsepsi Siswa pada Konsep Gaya. *JURNAL EKSAKTA PENDIDIKAN (JEP)*, *5*(1), 68-76.

Widada, W., & Rosyidi, A. (2018). Perancangan Media Pembelajaran Fisika SMP Berbasis Multimedia Interaktif. *IT CIDA*, *3*(2).

Zakaria, N., Mat, N., Baharum, H., & Sintian, M. (2016). Elements of Creative Thinking of the Malay Society Through Selected Written and Oral Literary Texts. *EDUCATUM Journal of Social Sciences*, *2*(1), 67-74.

Zuriah, N., Sunaryo, H., & Yusuf, N. (2016). *IbM guru dalam pengembangan bahan ajar kreatif inovatif berbasis potensi lokal*. Jurnal Dedikasi, 13