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PHYSICS TEACHING: DEVELOPMENT OF LECTORA INSPIRE WITH MULTIPLE-REPRESENTATION APPROACH TO REDUCE OF MISCONCEPTION

Khairunnisa[1]*, Ishafit[2], Suritno Fayanto[3]
[1,2]Department of Master in Physics Education, Universitas Ahmad Dahlan, Yogyakarta ,55161
[3]Physics Teacher , SMA-Tahfidzul Qur'an Mu'adz Bin Jabal, Kendari, 93231
*Email korespondensi : nisa.khairun27@gmail.com1

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Abstract: *This study aims to determine the validity of the development of multimedia learning physics with a multiple-representation approach to reduce misconceptions on the material momentum and impulses This research is a development study with ADDIE model which consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. This research using descriptive analysis techniques, i.e., with the yield on the validity of multimedia learning by using instruments of validation, Multimedia learning has been through a phase test validity by subject matter experts with an average percentage of 95.83% with very valid criteria, a media expert at 82.64% with very valid, and learning experts of 81.25% with a very valid, so that multimedia teaching physics with multiple representations valid approach used as a medium of learning in the classroom.*

Keywords ***: Multimedia, Multiple-Representation, Momentum Impulse, Lectora***

Abstrak: Penelitian ini bertujuan untuk mengetahui validitas terhadap pengembangan multimedia pembelajaran fisika dengan pendekatan multirepresentasi untuk mereduksi miskonsepsi pada materi momentum dan impuls. Penelitian ini merupakan penelitian pengembangan (Research and Development) dengan model pengembangan ADDIE yang terdiri dari lima tahapan yaitu Analysis, Design, Development, Implementation dan Evaluation. Penelitian ini menggunakan teknik analisis deskriptif, yakni dengan menghitung persentase hasil validitas terhadap multimedia pembelajaran dengan menggunakkan instrumen validasi. Multimedia pembelajaran telah melalui tahap uji validitas oleh ahli materi dengan persentase rata-rata sebesar 95,83% dengan kriteria sangat valid, ahli media sebesar 82,64% dengan kriteria sangat valid, dan ahli pembelajaran sebesar 81,25% dengan kriteri sangat valid, sehingga multimedia pembelajaran fisika dengan pendekatan multirepresentasi valid digunakan sebagai media pembelajaran di kelas..

Kata kunci : Multimedia, Multirepresentasi, Momentum Impuls, Lectora.

In physics learning in school still found students who have misconceptions. Based on Maulida research conducted at Sidoarjo High School, it found that students experienced misconceptions on sub-topic of the momentum of 73.1%, on impulse sub-topic at 86.1% and collision sub-topic at 84.3% (Ayu & Suliyanag, 2017). This misconception can be caused by students who have problems in understanding the concept of impulse-momentum. Limitations experienced by students on the concept of impulse-momentum with other students can not explain the physical meaning of

the impulse equation, students can not explain the physical meaning of the collision, and the student can not write the equation of impulse (Nufus *et al*., 2019). Alami *et al*., (2018) suggested that one example of students' misconceptions is that students cannot recognize mathematical relationships that are following the relationship between Newton II law and momentum and the relationship between concepts related to subjects. While Risch (2014) shows out that many students had misconceptions about how they apply Newton's laws, especially in the process of change speed or linkage effects of external forces. Misconceptions due to the knowledge and the initial concept established in the minds of students resulted in students having difficulty funding description concept if it not linked in everyday life (Diyanahesa *et al*., 2017).

Therefore, to reduce misconceptions, students on the topic of momentum and impulse necessary lessons appropriate solutions-So that researchers provide an alternative to use traditional adjustment multiple representations approach. Multiple representations physics by Kohl & Finkelstein, (2008) is the ability to resolve problems in physics in three different ways, namely the representation of verbal, mathematical, and visual. The physics concept presented with three representations can be more comfortable for students to change the abstract conception to be a symbolic model (Solihah *et al*., 2018). The study Solihah *et al*., (2018) found that by using multiple representations in learning physics students has increased cognitive abilities and problem-solving. The research Widianingtiyas *et al*., (2015) found that multi-representation can improve cognitive skills because it can build students' understanding of the information presented in various forms completely.

The results of previous studies indicate that learning with a multi-representation approach reduces the number of misconceptions that occur in students (Loviza, 2013). Learning with a multi-representation approach has high effectiveness in instilling conceptual understanding (Suhandi & Wibowo, 2012). To reduce misconceptions in understanding concepts, students can use different forms of representation or something commonly called multi-representation to make it easier for students to understand concepts (Alami *et al*., 2018; Widianingtiyas *et al*., 2015). In addition, using multi representation in presenting physics material in the classroom will increase opportunities for teachers to see students' abilities in understanding the concepts of physics topic taught (Sianturi & Abdurrahman, 2019). Rosa *et al*., (2018) suggested that 42.1% of students have a correct conception, and 43.17% of students have dual representation skills. Meanwhile, Haratua (Tms & Sirait, 2016) in the study, found that students completed more than one representation, such as motion diagrams, strength diagrams, while solving problems got higher scores than students did not. It shows that some of the representations can be effective in improving students' understanding of the concepts of physics and problem-solving skills. Multiple-representation so greatly assist students in reducing misconceptions will be on him.

To optimize the use of multiple representations, then supported learning using

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multimedia. Its because the use of multimedia can integrate various representations so students who need an understanding of specific representations can be helped with other representations (Widianingtiyas *et al*., 2015). Several studies have developed representations with various multimedia. However, it has not explicitly explained the validity or development of multimedia. The software often used in the development of instructional media is Adobe Flash, Course Builder, Visual Basic, Dream waver. However, its use is quite complicated that only controlled by a computer programmer (Ena, 2011). One software that can be used to develop learning media is Lectora Inspire. Lectora Inspire can be used for the learning needs of both online (offline), and offline (class system) can be created quickly and easily. Lectora Inspire can be used to combine flash files, record videos, combine images, and capture screens (Herdini *et al*., 2018). Lectora Inspire is an application as a tool for composing multimedia such as text, images, and animations with ease (Irwandani *et al*., 2019;Hunaidah *et al*., 2019). Besides, Lectora Inspire can make online training courses, assessments, and presentations quickly, effectively, and efficiently. On the other side of Lectora inspire offering display solutions comfortable because practical when used on Microsoft with some advantages (1) can be used to create a web site, (2) the content interactive E-learning, (3) the features presented very easy for novice users to make multimedia learning, and (4) the Lectora template complete enough (Sanwidi & Swastika, 2019; Zainuddin *et al*., 2019). When Kurniawan *et al*., (2019) in his work suggests that the use of media-based inspirational Lectora fit for use as a medium of learning to help students understand in the topic.

Therefore, from the explanation that has been described, researchers are interested in multimedia learning physics based on Lectora Inspire with a multi-representation approach to reduce misconceptions about the topic momentum and impulses. The goal to be achieved in the development of multimedia is to make a learning media that is valid and practical for use in the learning process by using a multi-representation approach.

LITERATURE REVIEW

Multiple-representation Approach

A multi-representation approach is an approach that uses various representations of the same concept with different formats in the learning process (Widianingtiyas *et al*., 2015). Rosengrant *et al*., (2007) stated the importance of using multi-representation, among others: (1) Students have different bits of intelligence, so students learn in different ways according to their intelligence; some are prominent in visual intelligence. But not in auditory intelligence; (2) Representation of the concrete more easily understood and needed to visualize physical concepts; (3) The representation of concrete that had built makes it easy to build a more abstract representation; (4) Qualitative reasoning readily formed from various representations; (5) Representation of mathematical abstract and trying to understand students' students can use to find solutions quantitatively.

In this study, the material presented in the form of three representations are representations of

verbal, mathematical representation and visual representation. The form of verbal representation is the presentation of physics problems in the form of language sentences. Example: "The momentum collision will be lasting if the amount momentum in the system does not change before, during, and after the collision, provided that only the internal force is acting on the system" (Hewitt, 2006). Verbal representations then converted into visual representations, and visual representations are the presentation of physical concepts in the form of actual images, or diagrams, or graphs to clarify abstract concepts (Andromeda *et al*., 2017).

Lectora Inspire

Lectora is a tool of multimedia authors (Authoring Tools) to create active multimedia learning (Mas'ud, 2014). Lectora is operated using hyperlink buttons that quickly set without error constraints (Putri *et al*., 2016). This application can work with animation, social media, PowerPoint, video, and questions can be answered immediately, giving rise to a reciprocal relationship between students and teachers (Akbarini *et al*., 2018).

Misconception

Misconceptions are students 'frameworks that are not by the framework of scientists' minds which are built from the student's fundamental knowledge. Misconceptions in physics are mostly from students. Misconceptions come from students can be grouped in several ways, including preconception or early conceptions of students, associative thinking, humanistic thinking, reasoning incomplete/wrong, intuition is wrong, the stage of cognitive development of students and student interest (Suparno, 2013).

Examples of misconceptions on material momentum and impulses include students assuming the momentum does not pay attention to the mass and velocity of objects caused by preconception (Anggraeni & Suliyanah, 2017). Students assume that the higher the mass of the object, the smaller the momentum will be because this student gives a less precise, less clear, and not logically connected explanation (Prihartanti *et al*., 2017).

Momentum & Collision

Linear momentum or momentum can be defined as the product of mass and velocity of the object. Momentum equation can be written as follows

$$\vec{p} = m\vec{v} \qquad (2)$$

Momentum is a vector quantity that has units in SI are kg.m /s (Giancoli, 2006).

Changes momentum of an object during a certain time interval equal to the net force acting on it during that interval, or so-called impulse. Impulse equation can be written as follows:

$$\vec{I} = \sum \vec{F} \Delta t \qquad (3)$$

Impuls is a vector quantity that has units in SI i.e N.s or kg.m / s (Young & Freedman, 2002).

When an object experiences a collision, the total momentum of the system shortly before the collision has the same magnitude as the total momentum of the system just before the collision, provided that no external forces work in the system (Rezeki & Ishafit, 2017).

Collision events are divided into three types, namely collision of perfectly resilient, collisions

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are not resilient at all, and collisions are not resilient at all (Purwanti & Pramudya, 2014).

The collision happened on the same two mass objects, where the object A object B stationary mashing. In perfectly elastic collision restitution coefficient e = 1 and apply conservation of momentum and kinetic energy conservation .

$$E_{k1} + E_{k2} = E'_{k1} + E'_{k2} \quad (4)$$

The collision that has a coefficient of restitution e = 0 so that the two bodies into one (joined) after collide and both objects have the same speed. So that the collision is not elastic at all apply mathematical equation:

$$m_1\vec{v}_1 + m_2\vec{v}_2 = (m_1 + m_2)\vec{v}' \quad (5)$$

Pada In the elastic collision partially applicable law of conservation of momentum with the coefficient of restitution is 0 <e <1. Kinetic energy conservation is not applicable due to changes in kinetic energy before and after the collision (Young & Freedman, 2002).

RESEARCH METHODOLOGY

Research Models

In this study, researchers used a research development method by adopting the step model of ADDIE (Analysis, Design, Development, Implementation, Evaluation). Researchers chose this model because it has stages that are easily learned and applied to product development in the form of multimedia learning (M & Kirna, 2013). At this stage of analysis, researchers analysed the problems and things that would develop into products such as analysing the syllabus and topic. Stage design researchers designed a concept map and storyboard in the form and format of learning media in general. Development stage researchers to produce media that contain material, pictures, and video. The implementation stage product that has been developing will be validated by subject matter experts, media experts, and learning experts. Evaluation stage the researcher revised the validation results on the product developed

Research Subject

The subject of this research that developed multimedia learning with multiple-representation approach. Multimedia then assessed for validity by engaging three experts as a validator.

Research Instrument

Data collection instruments use the validation sheet instrument given to media experts, material experts, and learning experts, namely one media expert as a validator who assesses the components of display quality, media, and reliability. One topic expert as a validator who evaluates the elements of the material coverage, material accuracy, and language, and one learning expert as a validator who assesses the multimedia component meets the requirements of conceptual change and the ability of multimedia to reduce misconceptions. The preparation of the questionnaire was adopted from previous research and then adapted to the needs.

Data Analysis Technique

Data analysis techniques by calculating the percentage of validation results obtained from media experts, material experts, and learning experts with the formula (Purwanto, 2006).

$$NP = \frac{SM}{R} \times 100\% \quad (6)$$

Where,
NP = a percentage score
R = total score
SM = maximum score

The assessment criteria in the experimental guide are presented in Table 1.

Table 1. Assessment Criteria

Ratio	Eligibility Level Criteria
80% – 100%	Very Decent/Very Good/Very Agree
66% – 79%	Decent / Good / Agree
56% – 65%	Inadequate / Poor / Agree
0 – 55%	Not Eligible/NotGood / Disagree

RESULTS AND DISCUSSION

The results concerned in this development are products in the form of multimedia learning with a multi-representation approach designed and developed by researchers. Design development of multimedia learning materials physics of momentum and impulse gives the concepts of momentum, impulse, the law of conservation of momentum, and other types of collisions.The development of instructional multimedia is created by analyzing the material and curriculum that will be used, then designing and producing a multimedia display of learning. It was followed by a validation test by one expert material, one media expert and one expert learning.

The following are the results of the development of multimedia learning with a multi-representation approach to the material momentum and impulses shown in Figure 1, Figure 2, and Figure 3.

Figure 1. Display the Main Page of Multimedia Development

Figure 1 shows the initial page on multimedia learning. On the start, a page has given a moving car that is colliding with another vehicle.

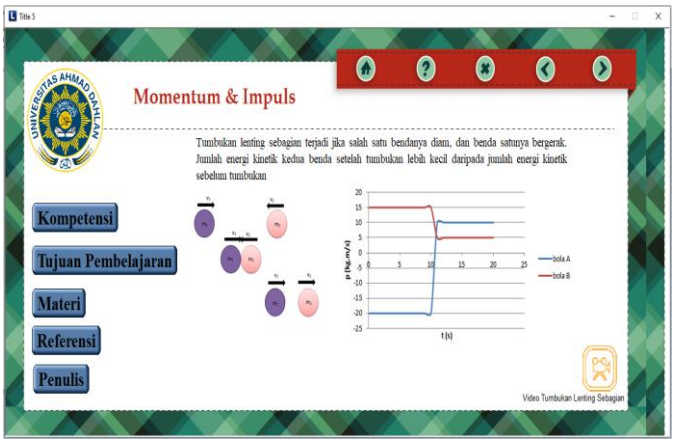

Figure 2. Display of Sub-Topic

Figure 2 identicate sub collision resilient topic in part by displaying representations of verbal, graphic, and visual-In verbal descriptions are presented the definition of partially resistant collisions. The visual image showed two balls that collide from the opposite direction after the second collision drove the ball toward the left simultaneously. In the graphical representation of the red line depicting the movement of ball A and the blue line representing ball B, the difference in the height of the graph shows the change in energy due to loss of energy after the collision. Changes in energy due to energy transformed into another energy, such as sound energy and heat energy (Giancoli, 2006). Then the elastic collision does not apply the law of conservation of energy. In the same page, there are navigation buttons to open a video that contains instances for a partial elastic collision

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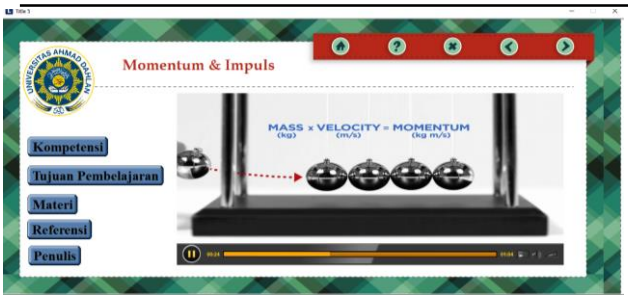

Figure 3. Video Display and Simulation in Learning

Figure 3 explain the video in the sub-topic law of conservation of momentum. The video contains an example of the application of the law of conservation of continued momentum on balls that collided with other balls. Before hit ball was thrown on the left numbered one ball, then after colliding, knocked the ball to the other end amounted to one as well. The number of balls between before and after the collision will be the same. These spheres had the momentum, and kinetic energy is constant because most of its kinetic energy into potential energy turns momentary elastic ended up going back into kinetic energy (Serway & Jewet, 2009).

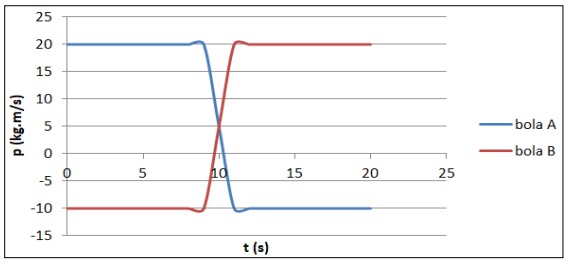

Figure 4. The Experimental Results of Students in Create a Relationship Graph p and t is a Perfectly Elastic Collision

Having finished products in the form of multimedia media subsequently tested by means validated by a validator 3 are subject matter experts, media experts, and learning experts. The validator will provide an assessment of the validity of the product. Then the validation results will be displayed through Figure. 5, Figure. 6 and Figure. 7

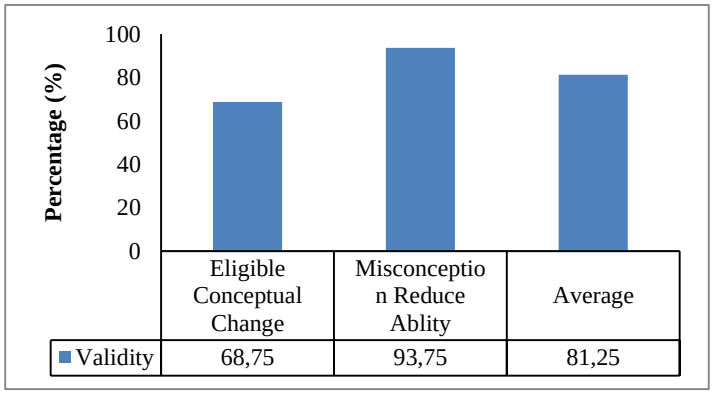

Figure 5. Percentage of Validation Results by Content Experts

The results of the validation (Figure 5) by the topic experts showed an average percentage of 95.83% with the value criteria very feasible to use for the physics learning process on topic momentum and impulses. Components of the range of material consist of six aspects, the accuracy of the material component consist of five points, and the language component consists of three elements. Some suggestions given by material experts include: adding examples of problems and their solutions, giving topic numbered from simple to complex content, and giving symbolic information to the impulse picture.

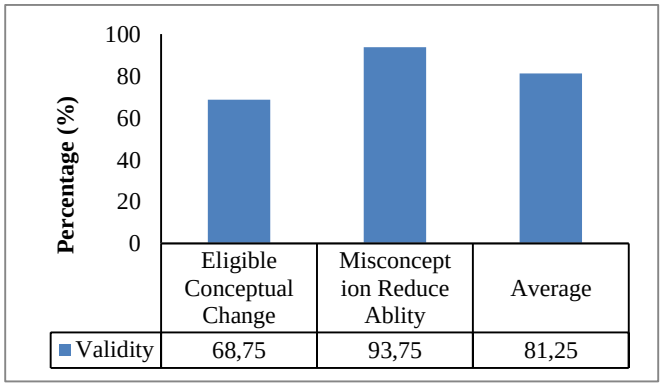

Figure 6. Percentage of Results of Validation by Media Experts

The results of the validation by media experts (Figure 6) obtained an average percentage of 82.64% with the value criteria very feasible to use to help the physics learning process. Component

quality of the display consists of six aspects, media component consists of four points, and component reliability consists of two elements. There are some suggestions given by the media experts, among others: the provision of blocking or container for the main menu, the image of the collision is described, given video source, and define the coefficient of restitution.

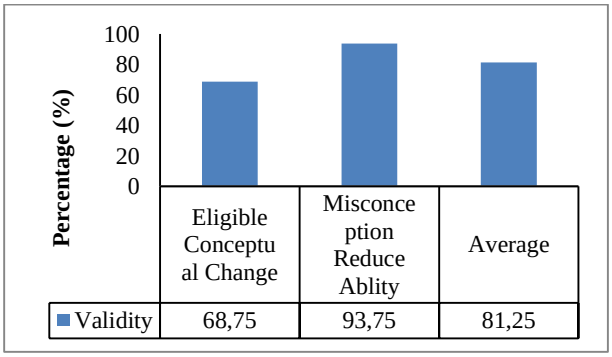

Figure 7. Percentage of Results of Validation by Learning Experts

The results of the validation by learning experts (Figure 3) obtained an average percentage of 81.25% with the value criteria very feasible to use to reduce misconceptions on the material momentum and impulses. The conceptual change component consists of four aspects, and the multimedia capabilities component consists of four elements. There are several suggestions given by learning experts, including issues of questionnaires number 3 and 4, which should be separated.

Based on the validation results showed that the physics-based learning multimedia valid multiple-representations developed to serve as a medium of learning for teachers in schools and can be used to reduce the misconceptions students. In this line with previous studies that found that the use of multiple-representations to explain a concept can help students understand the concept (Alami *et al*., 2018; Loviza, 2013; Suhandi & Wibowo, 2012).

CONCLUSION AND SUGGESTION

Conclusion

In this study, has been successfully developed multimedia teaching physics with a multiple-representation approach to the matter of momentum and impulse. Based on the assessment of learning multimedia conducted by subject matter experts, media experts and learning experts can be concluded that the developed multimedia has been declaring invalid use as a medium of learning physics.In this research is still in the initial design phase, then it will be implemented in extensive testing.

Sugestion

This research is part of the initial research. So it is necessary to further study the optimization of use in the learning process

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