

VALIDITY OF PHYSICS MODULE INTEGRATING CREATIVE THINKING ABILITY IN MOMENTUM AND IMPULSE MATERIALS

Yogi Aulia Putra ¹, Hufri ^{2*}

¹ Department of Physics, Universitas Negeri Padang, Jl. Prof. Dr. Hamka Air Tawar Padang 25131, Indonesia
Corresponding author. Email: hufri@fmipa.unp.ac.id

ABSTRACT

This research is motivated by the low student learning outcomes, the low student learning outcomes, among others, caused by the low creative thinking ability of students. This is partly because in learning students are not accustomed to developing their creative thinking skills, this condition is due to the lack of teaching materials that facilitate students in improving their creative thinking ability which result in learning outcomes. The solution is to develop a Physics learning module that integrates students' creative thinking skills. The purpose of this study was to determine the validity of the Physics learning module on Momentum and Impulse material in class X high school students. The type of research used is research and development (R&D) and the object of the research is a physics module that integrates creative thinking skills. The design model used is the ADDIE model. The research steps include: analysis, design, development, implementation and evaluation. Based on the data search that has been carried out, the normal value of the module validation is 89% which is included in the very valid criteria, so it can be said that the physics module of integration of creative thinking skills on momentum and impulse material can be said to be valid and can be used in class X physics learning in high school. By developing this learning module, it is hoped that students will be helped in the learning process independently.

Keywords : Module, Creative Thinking Ability, Low learning outcomes



Pillar of Physics Education is licensed under a Creative Commons Attribution ShareAlike 4.0 International License.

I. INTRODUCTION

The improvement of the quality of human resources (HR) must be carried out because HR is a priority of national policy which is intended to realize Indonesian people and people who have character and personality and are able to master the branches of science, technology, and art. This policy must be carried out gradually and consistently translated into national policies. The realization of national independence can only be realized through quality, relevant and equitable education [1]. Education is also an important aspect of life that can produce quality human resources. Law No. 20 of 2003 states that the purpose of holding education is so that human resources can be improved.

Increased Human Resources (HR) facilitates free market competition which requires creative and skilled human beings. From this statement, learning should be in line with 21st century skills termed 4C skills, namely communication (*communication*), collaboration (*collaboration*), critical thinking (*critical thinking*), and creative thinking (*creativity*). If this ability has been attached to students, then student learning outcomes also increase. One of the thinking skills in developing students' abilities with innovative reasoning abilities, understudy learning exercises should be worked with and roused to have the option to foster reasoning abilities through ideas and standards and have the option to take care of issues both subjectively and quantitatively [2].

Efforts made by the government to improve student learning abilities include making changes to the curriculum in schools, currently the 2013 curriculum has been set in schools. In addition, the teacher has also made various efforts such as providing learning resources for students to use in the learning process that is able to make students active in class. Based on the results of the 2019 UNBK from the province of West Sumatra [3], the Physics score was obtained with an average value of 47.5. The scores in Physics subjects at the 2019 Computer-based

National Examination are still low, judging by the data obtained from the Education research center of the Ministry of Education and Culture, the physics UN scores from urban communities/regions in West Sumatra territory are still low, this demonstrates that understudy learning results are still low.

The truth in the field shows that understudies' creative thinking abilities are still low, the reason for understudy learning results is still low since when the educator gives clarifications, understudies try to ignore. One of the reasons for the low student learning outcomes is that students are not facilitated in developing their thinking skills. According to [4] shows that students' creative thinking skills in learning physics in high school are still relatively low, as evidenced by giving questions about creative thinking skills, most students cannot answer correctly. This affects understudy learning results is also low. Based on research by [5] stated that the average creative thinking ability of students is around 25.5%, including the less creative category. This causes students' higher-order thinking skills are also low, and results in the low Human Development Index (HDI) of Indonesia, namely in 2017 it was ranked 113 out of 188 countries in the world [6].

In view of the consequences of the creative thinking ability test, the fluency aspect is 31%, the flexibility aspect is 28.6%, the originality aspect is 19%, and the elaboration aspect is 23.4%. The average percentage achieved at 25.5% is still classified as less creative[5]. According to [7] that the capacity to think creative is supposed to be low assuming the rate is <33%. It was tracked down that the understudies' creative thinking ability was still low in the non-creative category. Therefore, efforts are needed to improve students' creative thinking skills so that they can further develop understudy learning results.

It is critical to create creative thinking to help students solve problems and find alternative ideas in solving problems. The importance of developing creative thinking abilities is additionally contained in the objectives of public schooling, namely being able to develop students' potential thinking skills so that they become individuals who dread God Almighty, have honorable person, are sound, learned, fit, innovative, autonomous and capable[8]. Therefore, creative thinking skills need to be developed in learning activities to improve student learning outcomes. In accordance with[9] Creative thinking ability has a significant relationship to student physics learning outcomes, namely determining the high and low learning outcomes achieved by students, meaning that students who have high creative thinking skills will find it easier to learn than students. who have low creative thinking skills.

In view of the aftereffects of the book analysis,[10] shows that the analysis of two physics textbooks that are widely used in schools throughout West Sumatra, obtained the average value of each book is A worth 31.55 and book B is worth 37 with the less available category.

In research conducted by[11] and [12] regarding the analysis of the availability of creative thinking skills in the presentation of two high school textbooks that are widely used in schools, the results show that the average value obtained from the analysis of these textbooks is less than 40% categorized as less available so that the existing books have not facilitated students' creative thinking skills. From several descriptions, it can be seen that there are no instructing materials that can work with students' creative thinking skills in improving their learning outcomes, so it is necessary to develop showing materials as modules that can facilitate students' creative thinking skills.

As indicated by[13] states that there is a huge connection between creative thinking skills and learning outcomes. It can be concluded that student learning outcomes are still low due to the low creative thinking skills of students. Creative students will have good learning outcomes as well. To develop creative thinking, students need to be facilitated with instructing materials that can uphold learning. One of them is the instructing materials that can uphold learning.

The use of modules in teaching and learning activities does not only look at teacher activities, but also involves students actively in learning. By using the module can create an independent learning process. In the module there is systematic learning and can create learning conditions that make students actively and creatively involved, so that the module can improve students' creative thinking skills. Previously, research on modules to further develop creative thinking skills has also been completed. By stating that to improve student learning outcomes, creative thinking skills are needed to facilitate students in the learning process by using modules.[14], [2], [15], [16], [17], [18], [19] and [20]

In light of the foundation of the issue described, the researcher developed a module that can be used in learning physics, facilitating students' creative thinking skills. With the module as a learning resource, it can support student learning. Therefore, the researcher developed the subject matter in the physics module for class X semester 2 for momentum and impulse material because creative thinking can grow new ideas in the learning process, especially in momentum and impulse material. The aspect of creative thinking ability is in accordance with the 2013 curriculum. Therefore, the researcher raised the title of the research to be carried out is "Development of a Physics Module Integrating Creative Thinking Ability in Momentum and Impulse Material in Class X SMA Semester 2".

II. METHOD

The type of research conducted is Research and Development. Research and development methods or R&D are research methods used to produce certain items and test the adequacy of these items. The resulting product is a Physics module that integrates creative thinking skills of students about momentum and impulses materials. The study procedure was used according to the ADDIE Steps.

1. Analysis (Analysis)

At this stage of analysis, task analysis and concept analysis are carried out. Task analysis is a collection of procedures to determine the content in a learning unit. This analysis can be in the form of an analysis of basic competencies and subject matter materials. Furthermore, the formulation of appropriate learning indicators is carried out. This stage starts from the analysis of KI and KD for high school physics subjects to lower the indicators.

2. Design

Design is a guide that can provide direction, goals, and techniques taken to start and carry out an activity. At this stage, the design of the product is carried out. At the arranging stage, this is finished by getting ready different references, gathering a module system and planning ideas in the item. This module is organized by the module advancement rules by incorporating parts of creative thinking abilities.

3. Development

Product development is the process of realizing a design into a Physics module by integrating creative thinking skills. At this stage, the development of showing materials as modules and a combination of the content of the material that has been made in the design step will be carried out, then write or change the design of the module arrangement that has been arranged sequentially into modules according to the guidelines, making the display as needed.

4. Implementation

Implementation is a process so that the developed learning modules can be realized. The research implementation stage is the product validity test stage by experts. Furthermore, the data that has been obtained from the lecturer is analyzed data to decide the value of the legitimacy of the created module.

5. Evaluation.

This assessment stage is completed until a developmental assessment which focuses on the requirement for updates in light of the consequences of surveys by specialists and material science teachers that have been done at the execution stage. Furthermore, the validity of the data analysis was carried out. Validity data analysis is used for data in the form of input, analysis and ideas from specialists for further revision in stages for product development for the better. Evaluation is always carried out at every stage of development where this is aimed at the feasibility of the final product. Appropriate in terms of content, language, module appearance and creative thinking aspects that are integrated into the module.

Physics module validation assessment instrument integrates creative thinking skills to see the module's validity, the data from the expert responses are analyzed in the following two steps, firstly adding up the total scores of all experts for all indicators and secondly providing a validity scores. equation to get the total average score for all criteria: the value is obtained from the score obtained divided by the maximum score multiplied by one hundred percent.

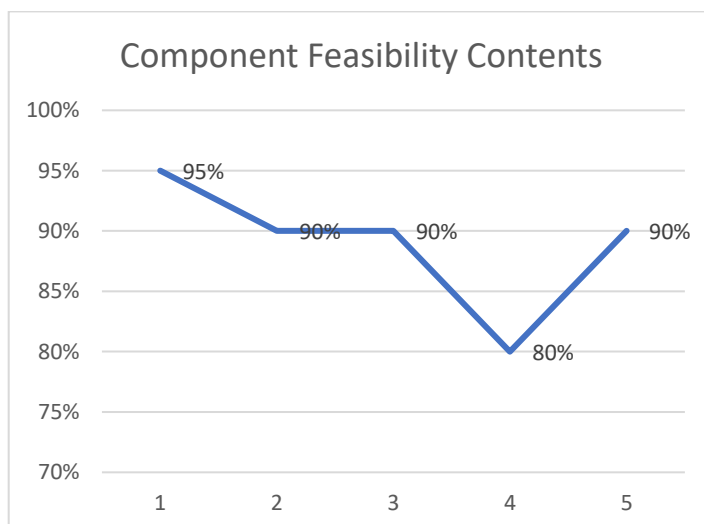
The validity level of the module can be seen[21] from 0 to 20 percent categorized as invalid, 21 to 40 percent categorized as less valid, 41 to 60 percent categorized as quite valid, 61 to 80 percent categorized as valid while 81 to 100 percent categorized as very valid. Classification of valid validity values utilized in this review in the event that it lies in the scope of values from 61 to 100, which is in the substantial and exceptionally legitimate models.

III. RESULTS AND DISCUSSION

The development of teaching materials in the form of a Physics module integrates students' creative thinking skills in momentum and impulse material. The results of this study are validation values by experts. Physics

module validation by experts to see the validity of the module. The Physics module integrates creative thinking skills validated by 4 experts. Remembering validation data assessment instrument by experts on the Physics module integrating creative thinking skills in momentum and impulse material, there are five assessment components consisting of content feasibility, construction feasibility, module display feasibility, Physics learning module feasibility and creative thinking ability component feasibility.

The first component of content feasibility consists of five indicators. The plot of the results of the feasibility of the contents of the Physics module integrating creative thinking skills can be seen in Figure 1.



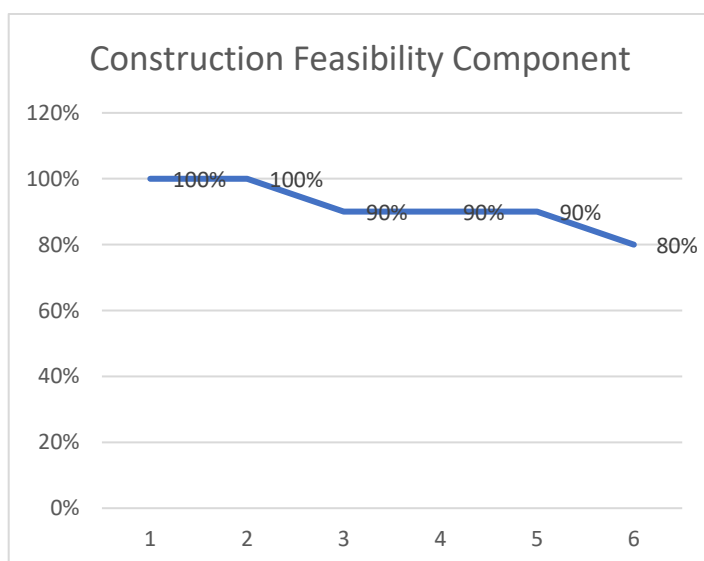
Description:

1. Learning modules are made in accordance with the Syllabus
2. The substance of the material in the learning modules is right
3. Learning modules are made as per the most recent issues
4. Realities of ideas/materials in the learning modules that are delivered are correct
5. Modules learning can add insight to knowledge

Figure 1. Worth of Validation on Content Feasibility Components

In light of the five parts of the substance attainability marker in the Physics module coordinating creative thinking abilities, the learning module made by the schedule is 95%, the worth of the substance of the material in the learning module is 90% right, the worth of the learning module made by the issue The most recent issue is 90%, the worth of current realities of the idea/material in the learning module that is conveyed is 80% right, the worth of the learning module can add understanding to information is 90%. Currently the indicator is in the valid category with a value range of 80% and 4 indicators are in the very valid category with a range of 90% to 95%. From the five indicators, it can be determined that the average value of the content feasibility component is 89%. Therefore, the feasibility component of the module content is in the very valid category.

Second, the construction feasibility component contains six indicators. The results of the data plot of the value of each construction feasibility indicator in the Physics module integrating creative thinking skills in the Momentum and impulse material are shown in Figure 2.



Description:

1. The writing system in the learning module is good
2. The request for the construction of the learning module is right
3. The goals in the learning module are clear
4. The information provided is good
5. Interactivity (stimulus and responses) in the learning module is clear
6. The data conveyed in the learning module is finished

Figure 2. Validation Value of the Construction Feasibility Component

In light of Figure 2 it very well may be made sense of that the worth of the construction feasibility indicator is in the range of 80% to 100%. The lowest indicator there is a value of 80% is in the valid category and the highest indicator is at 100% is in the very valid category. The typical worth of the development achievability part is 91% entirely set in stone by the worth of every one of these pointers indicators. So, the construction feasibility indicator can be stated in the very valid category.

The three components of language feasibility in the Physics module integrate creative thinking skills in the Momentum and Impulse material, there are five indicators. The results of the value data plot for each language feasibility indicator in the Physics module integrating creative thinking skills in the Momentum and Impulse material can be seen in Figure 3.

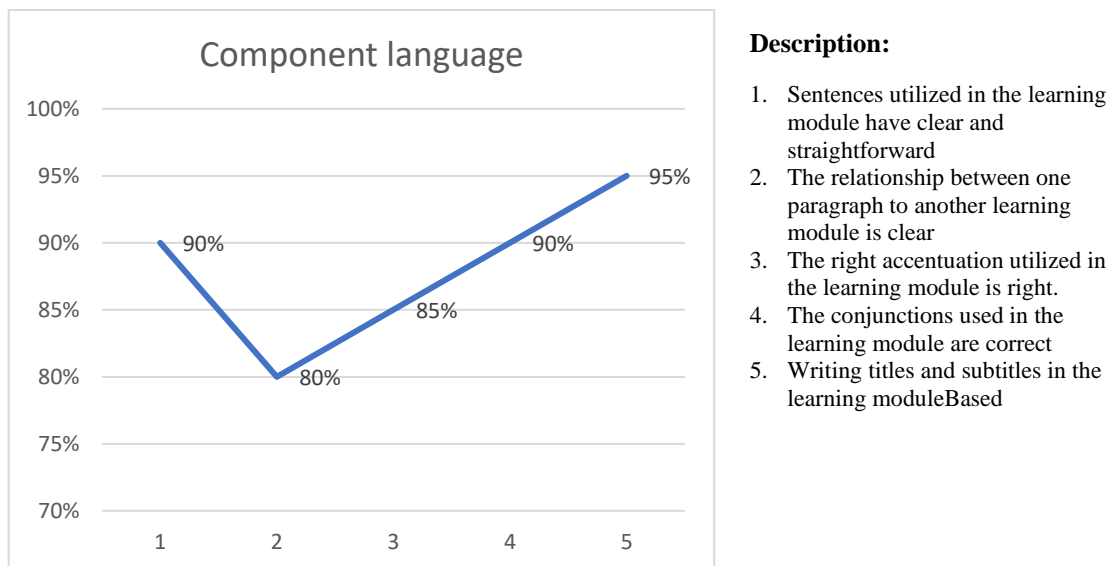
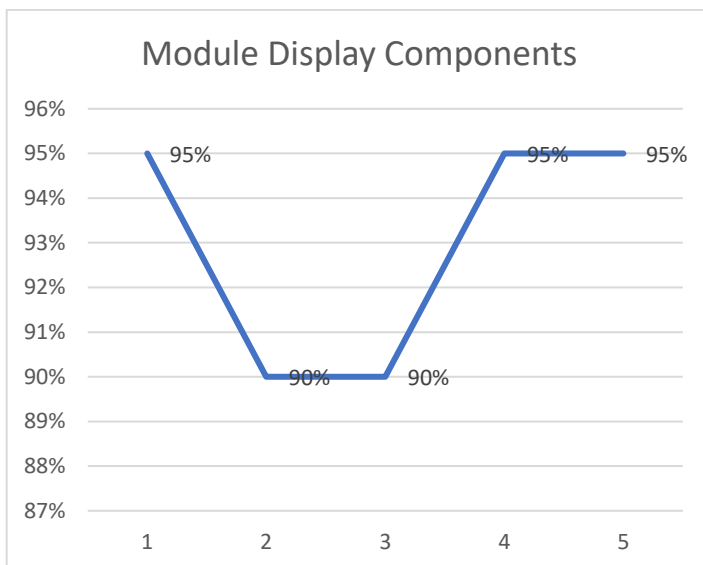


Figure 3. Validation Value on the Language Feasibility Component

on Figure 3 it very well may be made sense of that the worth of the language feasibility indicator in Physics integrating creative thinking skills in Momentum and Impulse material is in the range of 80% to 95%. It states that one of the five indicators is in the valid category with a value of 80% while the other four indicators are in the very valid category.

The typical score on the language qualification part is 88% entirely settled by the worth of every one of these pointers indicators. Therefore, the indicator of the feasibility of the Physics module language integrating creative thinking skills in the Momentum and Impulse material is in the valid category.

Fourth, the module show possibility part feasibility display component. In this case, there are five indicators. The results of the value data plot for each indicator of the feasibility of displaying the Physics module integrating creative thinking skills in Momentum and Impulse material can be seen in Figure 4.

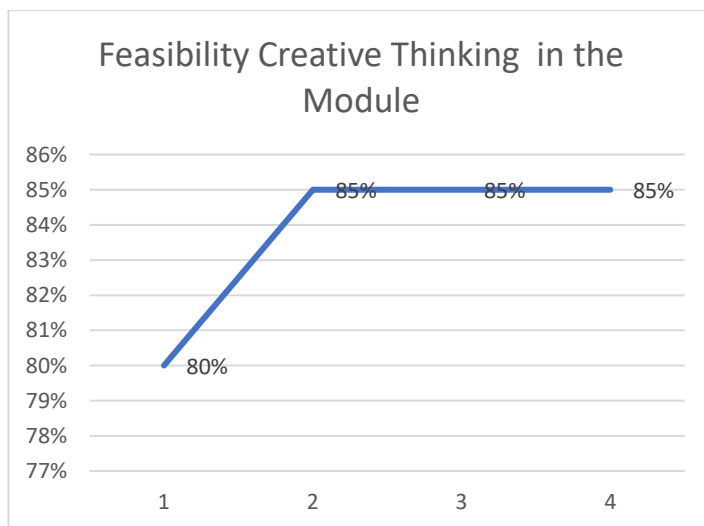
**Description:**

1. The presentation toward the start of the learning module is great
2. The format of titles and captions on the learning module is great
3. Types and the text dimension utilized in the learning module is proper and alluring
4. The format on the cover and between segments in the learning module is appealing
5. The situation of delineations, illustrations, and pictures in the learning module is alluring

Figure 4. Validation Value on the Feasibility Component Display Module

In view of Figure 4 can be made sense of that the worth of the five signs of the achievability of showing the Physics module to coordinate imaginative reasoning abilities in Momentum and impuls materials is in the range of 90 to 95%. It states that all indicators are in the very valid category. The typical value of the module showing the probability part is 93% entirely set by the value of each indicator marker. Therefore, the indicator of the feasibility of displaying the Physics module to integrate creative thinking skills in Momentum and Impulse material is in the very valid category.

Fifth, the component of the feasibility of creative thinking in the learning module has several indicators. The results of the value data plot for each indicator of the feasibility of creative thinking in the Physics module integrating creative thinking skills in the Momentum and Impulse material can be seen in Figure 5.

**Description:**

1. This module has directed students in communicating various thoughts in problems (*fluency*)
2. This module has directed students to provide variations in creative thinking, thoughts or answers to an inquiry (*flexibility*)
3. This module has directed students in providing somewhat innovative thinking in dealing with problems (*originality*)
4. The module has directed students to add, coordinate or calculate a thought with the aim of moving forward (*elaboration*)

Figure 5. Validation Value On the Feasibility Component *creative* Module

In view of Figure 5, it tends to be made sense of that the worth of the practicality pointer for creative thinking in the Physics module goes from 80% to 85%. One indicator is in the valid category and three indicators are in the very valid category. The creative thinking component of this Physics module consists of four indicators which include fluency, flexibility, originality, and elaboration. The average value of the *creative thinking* in the 83% modules are completely determined by the value of each of these indicators. The feasibility indicator for *creative thinking* in the Physics module to integrate creative thinking skills in Momentum and Impulse material is in the very valid category.

Based on the average value of each assessment component in the Physics module, integrating creative thinking skills in Momentum and Impulse material can be determined from the five components of the module.

The average value of the validity of the Physics module integrating creative thinking skills in Momentum and Impulse material for each assessment component is shown in Figure 6.

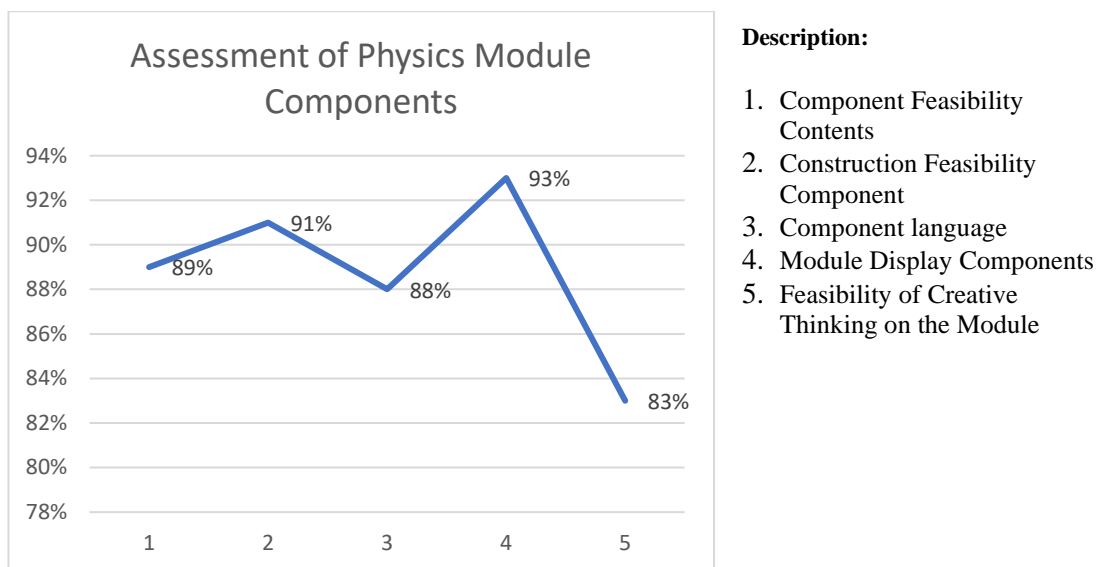


Figure 6. Average Value of Module Validation Assessment Components

Based on Figure 9, it very well may be seen that the average worth of every part of the Physics module integrates creative thinking skills in Momentum and Impulse material. The value of each module component varies from 83% to 93% with an average of 89%. Based on these values, it can be stated that overall the module components are in the very valid category. Thus, the Physics module integrating creative thinking skills in Momentum and Impulse material has a very valid level of validity. This indicates that the resulting product is in the valid category according to the product validation criteria that the value of 81-100 is in the valid criteria [22]. Thus, the Physics module integrating creative thinking skills in momentum and impulse materials has a very high level of validity.

There are several obstacles in this research. Constraints faced consist of three aspects that are considered necessary to know and find solutions. The first obstacle that the module developed is still limited, namely only one KD in class X SMA material, the second obstacle is the aspect of creative thinking skills used in the module, only four aspects of the nine existing aspects, and the third obstacle, namely the product quality test is still in a limited test, in only one class. The obstacles encountered can be explained in terms of the causes and the best solutions to get even better results in the future.

The first obstacle is that the modules developed are limited, namely only one KD, namely KD 3.7 in class X SMA. This is due to the limited time of researchers to design the Physics module. Alternative solutions and researchers' time limitations for Physics modules that can facilitate students' creative thinking skills can be overcome by further development of the scope of KD class X SMA in order to produce a complete Physics module. The second obstacle is the component of creative thinking ability which is used only four of the nine components. This is because researchers are still beginners in development. The solution to this problem is the Physics module, which can facilitate creative thinking skills, it is necessary to add more components of creative thinking so that student competencies can increase. The third obstacle is that the product quality test is carried out only up to a limited test, which is only one class. This is due to the limited time of the researcher. The solution that can be done is that the Physics module which facilitates students' creative thinking skills needs to be tested more widely so that the quality of this module is met.

IV. CONCLUSION

Based on the research results obtained and discussion of the validation of physics teaching materials on momentum and impulse materials, conclusions can be drawn. First, it has produced teaching materials for learning physics in the form of modules on momentum and impulse materials. Second, the teaching materials that have been produced on momentum and impulse materials have been in very valid criteria with an average validation value of 89%.

REFERENCES

- [1] Suryadi, A, *Pendidikan Indonesia menuju 2025*. Bandung : PT. remaja Rosdakarya, 2014.
- [2] Hufri, "Validation analysis of basic electronics textbooks 2 integrating creative thinking in the Physics Department, Universitas Negeri Padang," *J. Phys. Conf. Ser.*, vol. 1876, no. 1, 2021, doi: 10.1088/1742-6596/1876/1/012091.
- [3] Kemendikbud, Hasil Ujian Nasional Berbasis Komputer Sumatera Barat (hasilun.pusmenjar.kemdikbud.go.id). 2019.
- [4] Armandita, P., Wijayanto, E., Rofiatu, Susanti, A., & Rumiana, S, Analisis kemampuan berpikir kreatif pembelajaran fisika di kelas XI MIA 3 SMA Negeri 11 Kota Jambi. *Jurnal Penelitian Ilmu Pendidikan*, 10(2), 129-135, 2017
- [5] Amtiningsih, S., Dwiastuti, S., & Sari, D. P, Peningkatan kemampuan berpikir kreatif melalui penerapan guided inquiry dipadu brainstorming pada materi pencemaran air. In *Proceeding Biology Education Conference: Biology, Science, Environmental, and Learning*, 13(1), 868-872, 2016.
- [6] Fauzi, Y, Ranking Indeks Pembangunan Manusia Indonesia Turun ke-113. Jakarta: CNN Indonesia. 2017.
- [7] Rahayu, Susanto & Yulianti, Pembelajaran Sains dengan Pendekatan Keterampilan Proses Untuk Meningkatkan Hasil Belajar dan Kemampuan Berpikir Kreatif Siswa. *Jurnal Pendidikan Fisika Indonesia*, 7(2): 106-110. 2017.
- [8] Depdiknas, Undang-undang RI Nomor 20 tahun 2003 tentang Sistem Pendidikan Nasional. 2003.
- [9] Safitri, L. A., Rosidin, U., & Ertikanto, C, Hubungan Kemampuan Berpikir Kreatif dan Motivasi dengan Hasil Belajar Melalui Model PBL. *Jurnal Pembelajaran Fisika*, 2(3), 107-118, 2014.
- [10] Gemfly and Hufri, "Aspect Analysis Of Crative Thinking Ability On Newton'S Law, Work And Energy, Momentum Impulses, And Harmonic Vibrations In The 2nd Semester 10th Grade High School. Pillar of physics education," *Pillar Phys. Educ.*, 2021.
- [11] Dola and Hufri, "Material Analysis Of Rotation Dynamics, Heavy Points And Equilibrium Of Rigid Objects As Well As Elasticity And Hooke's Law, That Facilitate Creative Thinking Skills. Pillar of physics education," *Pillar Phys. Educ.*, 2021.
- [12] Afrinaldi and Hufri "Analysis Of Creative Thinking Aspects On The Measurement, Vector, And Motion Materials In Senior High Svchool. Pillar of physics education," *Pillar Phys. Educ.*, 2021.
- [13] Mutsaqofah, S, Hubungan Kemampuan Berpikir Kreatif dengan Hasil Belajar IPA Biologi untuk Siswa Kelas VII SMPN 32 Padang. Skripsi Thesis, UNP, 2019.
- [14] Hufri et al., "Analysis of basic electronics 2 textbook reviewed from the aspects of creative thinking in the physics Department of FMIPA UNP Padang," *J. Phys. Conf. Ser.*, vol. 1481, no. 1, 2020, doi: 10.1088/1742-6596/1481/1/012124.
- [15] F. Triani dan Hufri, "Basic Electronics Module Validation Integrating Creative Thinking in Diode Circuit Materials and Its Applications." *Pillar Phys. Educ.* Vol 6. No. 2. 2020.
- [16] R. Wahyuni dan Hufri, "Pengembangan Bahan Ajar Fisika Berbasis Pembelajaran Inkuiri Pada Materi Pelajaran Usaha dan Momentum Untuk Meningkatkan Kemampuan Berpikir Kreatif Siswa Kelas X SMA". *Pillar of physics education*. Vol 11. No.2, 2018.
- [17] Hasibuan, Naimis Syifa dan Hufri, "Pengaruh Bahan Ajar Fisika Berbasis Inkuiri untuk Meningkatkan Kemampuan Berpikir Kreatif Peserta Didik pada Materi Momentum, Impuls dan Getaran Harmonik Sederhana Kelas X SMAN 8 Padang". *Pillar Of Physics Education*. 11(3), 2018.

- [18] Chairani, Yulia dan Hufri, “Analisis Validitas dan Praktikalitas Modul Fisika Berbasis Kemampuan Berpikir Kreatif Pada Pokok Bahasan Suhu, Kalor dan Teori Kinetic Gas Untuk Meningkatkan Hasil Belajar Siswa Kelas XI SMA/MA”. *Pillar Of Physics Education*. 13(3), 2020.
- [19] M. Soviana et al, Pengembangan Modul Berbasis Masalah untuk Meningkatkan Keterampilan Berpikir Kreatif Siswa. *Jurnal Kependidikan Fisika*, 5(2): 41-47, 2017.
- [20] Almuharomah, F. A., Mayasari, T., & Kurniadi, E, Pengembangan modul fisika stem terintegrasi kearifan lokal “beduk” untuk meningkatkan kemampuan berpikir kreatif siswa smp. *Berkala Ilmiah Pendidikan Fisika*, 7(1), 1-10, 2019.
- [21] Irani, S., Hufri, H., & Dwiridal, L, Validasi Multimedia Pembelajaran Fisika Berbasis Inkuiri dengan Pendekatan Sainifik pada Materi Pelajaran Usaha, Energi dan Momentum untuk Meningkatkan Kemampuan Berpikir Kreatif. *Pillar Of Physics Education*, 11(3), 49-56, 2018.
- [22] Riduwan, Skala Pengukuran Variabel-variabel Penelitian. Bandung: Alfabeta, 2005.