Design of Identify, Decide, Act, Communicate, Reinforce (IDACR) Module Based on Evaluation Ability in Learning Momentum Concepts

Warsini Wulandari[1], Siska Desy Fatmaryanti[2], Sriyono[3]
wwulandari2027@gmail.com[1], sd_fatmaryanti@yahoo.com[2], srious@yahoo.com[3]

Universitas Muhammadiyah Purworejo, Jl. K. H. Ahmad Dahlan 3 Purworejo Indonesia[123]

Abstract. It becomes a necessity for developing teaching materials with a learning model that makes students more active and can improve students' high-level thinking skills, especially the ability to evaluate. The design of new teaching materials has been carried out in the form of modules in momentum concept learning. Modules are generated using the stages of the Identify, Decide, Act, Communicate, Reinforce (IDACR) learning model with evaluation capabilities. There are also information processing characteristics in this module. Therefore, in the competency test, before students answer the questions presented information relating to the questions asked. The focus of the research is the validation and analysis of content on the module. The validity of the module is based on expert judgment and the content analysis of momentum concepts using indicators of students' evaluation ability. The instrument used is a validation sheet for material experts, media experts and Physics teachers. The results of this study indicate IDACR module based on evaluation ability in learning momentum concepts are valid and feasible to use in learning. The average value given by the validator is 3.60 with good and reliable categories with a percentage agreement (PA) of 99.0%. Through content analysis it was found that the module facilitates students in symbol identification and equality recognition in problems. This module design can be implemented in momentum concept learning to improve students' evaluation abilities.

Keywords*:* evaluation ability, IDACR, modules, momentum

1 Introduction

Physics is an important subject to be learned by students at the high school level. This is because physics can foster cognitive abilities of students that are useful for solving problems in everyday life, to equip students with knowledge and understanding so that they can enter a higher level, and to develop science and technology [1], [2]. Therefore, the ability to think needed at the high school level is the ability to think at a higher level.

Based on observation at senior high schools, physics learning process in the classroom was done by lecturing, answering questions and writing on the board. The obstacles or problems encountered during the Physics learning process are that there are still many students who are less active in learning and have not been able to explore their thinking skills [2], [3], they only accept and memorize what the teacher conveys [4]. Teaching materials used in

ICE 2019, September 28-30, Purwokerto, Indonesia

DOI 10.4108/eai.28-9-2019.2291093

learning are student worksheets and supporting books in the library. The teaching materials are less varied in terms of appearance so that make students feel bored to study Physics. In addition, these teaching materials are still very general and have not been able to maximize the ability to think at a higher level, especially in the aspects of evaluating and creating. Therefore, the ability to evaluate students needs to be improved so that it is easier to improve the ability to create, so students have the ability to think at a higher level as a whole. Based on the explanation above, we need a teaching material with a learning model that makes students more active and can improve students' high-level thinking skills, especially the ability to evaluate.

The evaluate ability means the ability to assess a material and the way to produce objectives including checking and criticizing [5]. Evaluating is one of bloom's taxonomic levels in higher-order thinking skills. According to Bloom, higher-order thinking skills are the most abstract skills in the cognitive domain, which include analysis (C4), synthesizing (C5), and evaluating (C6) [6]. The ability to evaluate is the ability to make decisions based on criteria and or standards. The criteria most often used are quality, effectiveness, efficiency, and consistency. The cognitive process of evaluating includes the ability to criticize and examine [7]. From the aspect of checking it can be explained that students can find errors from a case and find solutions or problem solving in accordance with the case. From the aspect of criticizing it can be explained that students can find the accuracy of a procedure to solve a problem and determine the suitability of the case with the existing theory. From this explanation it can be concluded that the indicators used in this study are the identification of symbols and the recognition of equations in the problem.

One model that can improve the ability to evaluate is the learning model Identify, Decide, Act, Communicate, Reinforce (IDACR) [8]. The IDACR learning model is a combination of the Thinking Actively in a Social Context (TASC) model and Gagne's learning theory. TASC which is in line with Bloom's taxonomy can train students to conduct investigations and problem solving so that students can use their thinking skills, both lower and high order thinking [9]. Therefore, the use of the IDACR model in the development of the momentum module is expected to improve the ability of students to evaluate.

2 Method

This research was a development research with ADDIE model with focus on design step. This step included the validation and analysis of content on the module [10]. The method used was quantitative and qualitative analysis. The instrument used to measure the validity of the IDACR-based Physics module. The module validity data is obtained from the validation sheet by the validator.

The validity data of the IDACR-based Physics module was obtained from the assessment of material experts, media, and Physics teachers. Validation data analysis of Physics modules based on IDACR is done by converting quantitative data into qualitative data. The purpose of changing the data type is to find out the quality category of the product being developed. Quantitative data processing is done by changing the validator assessment score. Qualitative data in this study were obtained from the concept of momentum content analysis using indicators of students' evaluation ability.

3 Results and Discussion

The product of this research is IDACR Module Based on Evaluation Ability in Learning Momentum Concepts. IDACR is a learning model characterized by information processing based on Gagne's learning theory. The activities carried out by teachers and students in each syntax of the IDACR learning model [8] modified are listed in **Table 1**.

Table 1. Activities undertaken by teachers and students in each syntax of the IDACR module

Syntax IDACR	Activity	
	Teacher	Student
Identify	1. Showing problems related to the material to be studied. 2. Asking a few questions that direct students to identify problems.	1. Paying attention to the problems presented by the teacher. 2. Pay attention to the direction of the teacher and identify the problem.
Decide	Provide opportunities for students to make decisions to solve problems.	Answering questions to solve problems
Act	1. Directing students to conduct experiments related to everyday problems. 2. Directing students to answer questions about experiments.	1. Conduct experiments. 2. Answering questions related to experiments.
Communicate	1. Directing students to record the results of the discussion. 2. Directing students to present the results of work in front of the class and evaluate together	1. Record the results of the discussion. 2. Present the results of the discussion, provide an assessment and critique of the results of the discussion.
Reinforce	Give students the opportunity to write down what has been obtained during learning and ask for material that is not yet understood.	Learners write conclusions related to the material that has been studied and ask for material that is not yet understood.

Validity test is done by requesting an assessment of material experts, media, and Physics teachers. The results of the assessment by material experts, media, and Physics teachers on the IDACR Module Based on Evaluation Ability in Learning Momentum Concepts which include aspects of content eligibility, linguistic aspects, aspects of design and appearance, presentation aspects, aspects of consistency, and aspects of usefulness are presented in **table 2**.

Table 2. Data validation analysis design of IDACR module based on evaluation ability in learning momentum concepts

No.	Aspect	Average Score	Reliability	Average Value	Category
1	Content Feasibility	24,5	98,0%	3,52	Well
2	Linguistic	11,5	95,7%	3,78	Well
3	Presentation	9,75	92,3%	3,33	Passably
4	Design and Display	8	100%	4,00	Well
5	Consistency	3,5	85,7%	3,67	Well
6	Usefulness	3,5	85,7%	3,33	Passably
	Average	10,12	99,0%	3,60	Well

Based on table 2, it can be seen that most of the aspects assessed by the validator scored in either category. The mean score given by expert lecturers is also in good category. Thus, the IDACR Module Based on Evaluation Ability in Learning Momentum Concepts is valid and suitable for use in learning with minor revisions.

Before the IDACR Module Based on Evaluation Ability in Learning Momentum Concepts was said to be valid and feasible to use, the researchers made several revisions. Revisions are made based on input from the validator. According to the expert lecturer, the things that need to be improved in the aspect of content suitability are that the contents of the module are still not oriented towards information processing in accordance with the IDACR model. To improve this the researcher refines the module contents by putting more emphasis on processing information according to the steps of the IDACR model. This is in accordance with Gagne learning theory, that there are phases in learning [11]. In addition, expert lecturers also provide input to present detailed material. In the aspect of presentation, expert lecturers suggest adjusting between problem solving and the IDACR model so that researchers improve the problem solving presented identify (identify), decide (decide), act and communicate (act and communicate), and reinforce (strengthen). Design and appearance aspects, expert lecturers suggest that in module printing must be clear, the use of images in the module must be proportional, and the images presented do not include sources so researchers improve the size of the images and add sources to each image.

In each syntax in the IDACR Module Based on Evaluation Ability in Learning Momentum Concepts aims to improve the ability of students to evaluate. For example, in the first stage of the decide phase, students are asked to decide through the questions raised namely how to slow down the ball so that it can be controlled properly. From these question students can practice practicing finding solutions or solving problems in accordance with the case of momentum. In the act stage, experiments are presented relating to daily life. This stage is used to practice the ability of students to find the accuracy of a procedure to solve problems [12], [13]. One of the experiments presented is an experiment about volleyball and ping pong balls.

There are also information processing characteristics in this module. Therefore, in the competency test, before students answer the questions presented information relating to the questions asked [14]–[16]. One of the information presented is about the slingshot and its working principle when played. When the handle of the catapult is pushed and the ejection base along with the gravel is pulled. Slingshots will stretch. When the catapult rubber is removed, there is a push against the gravel, then an impulse arises which works on the gravel. After the gravel is released and on an object there will be a momentum. The information is related to the problem presented about how much the speed of the stone when it comes to mangoes if Budi is playing a slingshot using the target of a 0.5 kg mango that is hung using a rope. The stone used to aim at mangoes has a mass of 0.01 kg. So that after the collision of stones embedded in the mango and the position of the mango has increased h by 20 cm. Students' answers can be seen in Figure 1.

Fig. 1. Examples of student answers

From the answers of students can be seen that, students are able to identify symbols and be able to apply equations to solve a problem. This is in accordance with the evaluating indicators used in this study [17], [18]. Problem solving is also a cognitive activity, using a combination of knowledge, leading to inferences to conclusions. It can be done through heuristic strategies, including steps to see a picture of the problem in general, sketches, diagrams, graphs, equations and related quantities [19]. Another strategy is an algorithm, which is a strategy that guarantees a solution to a problem [20].

4 Conclusion

From the results of data analysis, it was found that *IDACR Module Based on Evaluation Ability in Learning Momentum Concepts* valid and suitable for use in learning. The average value given by the validator is 3.60 in the good and reliable category with a percentage agreement (PA) of 99.0%. Through content analysis it is found that the module facilitates students in identifying symbols and recognizing equations in problems. The design of this module can be implemented in the concept of momentum learning to improve student evaluation skills.

References

[1] E. Tabor-Morris, "Thinking in terms of sensors: personification of self as an object in physics problem solving," *Phys. Educ.*, vol. 50, no. 2, pp. 203–209, 2015.

[2] H. Retnawati, H. Djidu, E. Apino, and R. D. Anazifa, "TEACHERS ' KNOWLEDGE ABOUT HIGHER-ORDER THINKING SKILLS AND," *Probl. Educ. 21st Century*, vol. 76, no. 2, 2017.

[3] A. P. Dungsungnoen, "Student ' s Perceived Level and Teachers ' Teaching Strategies of Higher Order Thinking Skills ; A Study on Higher Educational Institutions in Thailand," *J. Educ. Pract.*, vol. 7, no. 12, pp. 211–219, 2016.

[4] S. D. Fatmaryanti, Suparmi, Sarwanto, Ashadi, and H. Kurniawan, "Magnetic force learning with Guided Inquiry and Multiple Representations Model (GIMuR) to enhance students' mathematics modeling ability," *Asia-Pacific Forum Sci. Learn. Teach.*, vol. 19, no. 1, pp. 1–22, 2018.
[5] I. Goksu, "The Evaluation of the Cognitive Learning Process of the Renewed Bloom Taxonomy Using a Web Based Expert System," *Turkish online J. Educ. Technol.*, vol. 15, no. 4, pp. 135–151, 2016.
[6] L. W. Anderson and D. R. Krathwohl, *A Taxonomy for Learning , Teaching , and Assessing : A Revision of Bloom ' s Taxonomy of Educational Objectives*. Pearson, 2000.
[7] A. C. Butler, E. J. Marsh, J. P. Slavinsky, and R. G. Baraniuk, "Integrating Cognitive Science and Technology Improves Learning in a STEM Classroom," *Educ. Psychol. Rev.*, vol. 26, no. 2, pp. 331–340, 2014.
[8] R. Tunnur and Mundilarto, "Pengembangan Model Idacr untuk Meningkatkan Kemampuan Mengevaluasi Peserta Didik SMA pada," in *Prosiding Seminar Nasional Pascasarjana*, 2017, pp. 25–34.
[9] H. E. Vidergor, "Effectiveness of the multidimensional curriculum model in developing higher-order thinking skills in elementary and secondary students," *Curric. J.*, vol. 5176, no. May, 2017.
[10] J. Creswell, *Education Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. Boston: Person Education, 2012.
[11] B. Wallace, *Teaching thinking skills an inclusive approach*. London: A NACE-Fulton pub, 2006.
[12] J. L. Docktor, N. E. Strand, J. P. Mestre, and B. H. Ross, "Conceptual problem solving in high school physics," *Phys. Rev. Spec. Top. - Phys. Educ. Res.*, vol. 11, no. 2, 2015.
[13] J. L. Docktor *et al.*, "Assessing student written problem solutions: A problem-solving rubric with application to introductory physics," *Phys. Rev. Phys. Educ. Res.*, vol. 12, no. 1, p. 010130, 2016.
[14] A. Kawalkar and J. Vijapurkar, "Scaffolding Science Talk: The role of teachers' questions in the inquiry classroom," *Int. J. Sci. Educ.*, vol. 35, no. 12, pp. 2004–2027, 2013.
[15] S. D. Fatmaryanti, Suparmi, Sarwanto, and Ashadi, "Interactive Demonstration with Multiple Representation in Learning of Magnetic Field Concepts," *Sci. J. Phys. Math. Educ.*, vol. 4, no. 4, pp. 138–142, 2017.
[16] S. D. Fatmaryanti, Suparmi, Sarwanto, and Ashadi, "Student representation of magnetic field concepts in learning by guided inquiry," *J. Phys. Conf.Series*, vol. 795, 2017.
[17] S. Fatmaryanti, Suparmi, Sarwanto, and Ashadi, "Attainment of students ' conception in magnetic fields by using of direct observation and symbolic language ability Attainment of students ' conception in magnetic fields by using of direct observation and symbolic language ability," *J. Phys. Conf. Ser.*, vol. 909, 2017.
[18] Y. Aydin, "The Effects of Problem Based Approach on Student's Conceptual Understanding in a University Mathematics Classroom," *Procedia - Soc. Behav. Sci.*, vol. 152, no. September 2013, pp. 704–707, 2014.
[19] P. Schwartz, "Focusing on Concepts by Covering Them Simultaneously," *Phys. Teach.*, vol. 55, no. 5, pp. 280–284, 2017.
[20] E. Demiray, "Problem in women's education in turkey Implementation and suggested solutions," *Int. J. New Trends Educ. Their Implic.*, vol. 6, no. 1, 2015.