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# Article 8

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# Developing Critical Thinking Skills-Based Learning Set of Basic Physics Subject Using Edmodo in Android Platform

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## ABSTRACT

The purpose of this study was to obtain a set of Basic Physics learning, which was developed based on critical thinking skills using the Android platform Edmodo application. This research type was a research and development by analysis, design, development, implementation, and evaluation (ADDIE) model. The results of the validation of content and learning set by the expert indicated valid and reliable categories and can be used with minor revisions or without revisions in Basic Physics learning. The results of critical thinking skills measurement showed a significant increase of N-Gain in the medium category and practical for application in learning. The results of the questionnaire analysis showed the positive responses to Basic Physics learning, and they said that it was easy and practical to use. Basic Physics learning set which was developed in this research met the aspects of validity, practicality, and effectiveness which is promising to be applied as the media of online learning in the higher education system in the era of industrial revolution 4.0.

## ABSTRAK

Tujuan penelitian ini adalah memperoleh seperangkat pembelajaran fisika dasar berbasis keterampilan berpikir kritis menggunakan aplikasi edmodo berplatform android. Penelitian ini termasuk penelitian dan pengembangan mengikuti langkah – langkah pengembangan model ADDIE antara lain analysis, design, development, implementation dan evaluation. Hasil validasi konten dari ahli media menyatakan bahwa perangkat pembelajaran memiliki kategori valid da reliabel serta dapat digunakan dengan revisi kecil atau tanpa revisi. Hasil penelitian menunjukkan bahwa keterampilan berpikir kritis mengalami peningatan yang signifikan dengan N-Gain kategori sedang, hal ini menunjukkan bahwa perangkat pembelajaran memiliki kategori efektif. Hasil angket tentang  respon mahasiswa terhadap pembelajaran fisika dasar adalah positif dan mudah digunakan, hal ini menunjukkan perangkat pembelajaran memiliki kategori praktis. Sehingga dapat diambil kesimpulan bahwa perangkat pembelajaran fisika dasar berbasis keterampilan berpikir kritis menggunakan aplikasi edmodo berplatform android yang dikembangkan memiliki kualitas kriteria baik karena memenuhi aspek validitas, kepraktisan dan keefektifan. Manfaat penelitian ini yaitu sebagai media pembelajaran daring (learning online)  fisika dasar dalam sistem pendidikan perguruan tinggi pada era revolusi industri 4.0.

Keywords: ADDIE; Critical Thinking Skills; Edmodo; E-learning

## INTRODUCTION

The development of open source software application for education and communication technology has changed the way the interaction between lecturers and students in teaching and learning activities.

Nowadays, the interaction between lecturers and students are both in the form of of-fline and online courses. The online interaction can occur synchronously involving the interaction between lecturers and students at the same time in a video conference; or asynchronously, where the interaction between lecturers and students happens at different times such as via e-mail (Ghirardini, 2011). Therefore, learning in the era of industrial revolution 4.0 is not only limited by space and time.

Edmodo application is an open source education application available at http://edmodo.com and on the Android smartphone play

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store. Edmodo is potential to be applied for learning support in Indonesia. With the fact that Android smartphone users in Indonesia reach around 65 million people (25%) of Indonesia's total population (Kemenristekdikti, 2017). Also, most Android smartphone users in Indonesia are ranked first in social media activities (Kakihara, 2015). Indonesian students use Android smartphones features, especially social media applications such as Facebook and WhatsApp, as everyday communication tools. The Edmodo application platform appearance is similar to social media, which allows students to interact in a group like using Facebook with more personal and secure activities. For example, only students who have a group code (class name) from lecturers who can join the group (Kongchan, 2012). Also, Edmodo is more user-friendly, and it is easier for students than other platforms since its design is similar to Facebook an in general, students are used to using Facebook (Suriadhi, Kade, & Suwatra, 2014). It has proven that Edmodo can give motivation to students and provides opportunities for students to learn (Coca & Slisko, 2013) actively. Therefore, Edmodo application is a particular social media to support education for lecturers, students, and parents in learning.

Based on observations on the Basic Physics learning process in the Mathematics Education study program of STKIP Bangkalan, students in the first semester of the 2017-2018 school year showed that they learned this subject by generally based on the cognitive domain only, i.e., to memorize and to apply formulas where the learning achievement was measured based on the ability to remember and to use formulas in mathematical calculations. Therefore, the learning process was meaningless. Permendikbud No. 49 Year 2014 states that the achievement of KKNI curriculum learning consists of attitudes, mastery of knowledge, special skills, and general skills; whereas the Physics learning objectives based on the KKNI curriculum require students to master the principles and applications of physics in depth by utilizing the development of information technology and can make strategic decisions.

Therefore, lecturers must be able to make the Basic Physics learning set which can train the higher order thinking skills of students. One of the learning set designs is by using Edmodo in Android platform can encourage students to find out from various sources of information, emphasizing cooperation in solving problems. In this case, the lecturers must be able to use the Android platform Edmodo application in learning Basic Physics, and they do not need to design the application.

Critical thinking is the skill of using cognitive thinking in dealing with a problem consisting of knowledge, understanding, application, analysis, synthesis, and evaluation (Bloom, 1956). Critical thinking is the process of thinking for reflectively solving a problem with logical, rational arguments, by collecting and interpreting information and evaluating information to make a decision (James, 2015). In this research, the indicators of critical thinking skills include identifying problems, solving problems, and making conclusions. In Basic Physics learning, problem identification is gathering information and understanding problems about temperature and heat; whereas the problem solving is applying of principles and analyzing the concepts of temperature and heat. The conclusion drawn is evaluating the resolution of temperature and heat problems.

The Regulation of Minister of Research, Technology, and Higher Education Number 44 of 2015 states that higher education must develop learning tools as curriculum implementations. This research produced the Basic Physics learning set based on critical thinking skills ability by employing Edmodo in Android platform as a form of the industrial revolution era 4.0 learning to improve the ability of students in terms of Information Technology (IT), Operational Technology (OT) and Internet of Things (IoT). Basic Physics learning set developed includes lesson plan (LP), unit lesson plan (ULP), modules, Student Task Plans (RTM), and critical thinking skills assessment sheets.

The excellent quality of the learning set is indicated by its validity, practicality, and effectiveness (Nieveen, 1999). The validity of the learning set consists of content and experts validity in science/Physics education and learning media. The practicality of learning set is indicated by minor/without revision results from the expert assessment. The learning set is effective if the learning objectives can be achieved, and the student response towards learning is positive.

In this research, a Basic Physics learning set using Edmodo in Android platform to enhance the students critical thinking skills was developed. Also, the validity, practicality, and effectiveness of Basic Physics learning set were measured.

## METHOD

This research employed to research and development using the ADDIE model. The Basic Physics learning set was developed based on critical thinking skills criteria using Edmodo in Android platform (Dick & Carey, 2001). The ADDIE model included the stage of analysis, design, development, implementation, and evaluation.

The analysis phase was conducted in sequential order as follow: need analysis; learner characteristics analysis; as well as topic and task analysis. The design phase determined the learning outcomes, sequenced the objectives of learning, and chose the instructional strategies, media, instructional resources, as well as the assessment tool. The develop phase was conducted for the development of the learning set. The implementation phase involved testing of the learning set. Evaluation phase was evaluating the achievement of learning objectives, learning activities, activities, and student responses.

The subject of this research was 16 students of Mathematics Education Study Program STKIP PGRI Bangkalan who were enrolled in Basic Physics course semester II year 2018/2019.

Data collection used a learning set validation sheet, student response questionnaires to Basic Physics learning set based on critical thinking skills using the Android platform Edmodo application and tests of critical thinking skills.

The analysis of learning set validation employed the qualitative descriptive method on the average score of learning set assessment from both validators (P) and converted by criteria (Ratumanan & Laurens, 2013). The evaluation of content validity included aspects of content, presentation, and language; the assessment of expert validity consisted of content, navigation (hyperlink), structure and design, multimedia, and authenticity.

| | |
|---|---|
| $3.6 \leq P \leq 4.0$ | Very Valid |
| $2.6 \leq P < 3.6$ | Valid |
| $1.6 \leq P < 2.6$ | Less Valid |
| $1.0 \leq P < 1.6$ | Not Valid |

The reliability of the learning set used formula

$$R = \left| 1 - \frac{A-B}{A+B} \right| X100\%$$

Description :

R = Percentage of Agreement
A = score from the validator who gave high score
B = score from the validator who gave a low score

The instrument which was developed is reliable if the score reaches $\geq 75\%$ (Arikunto, 2006).

The analysis of students' critical thinking skills was conducted based on an increase in the indicator score at the pretest and posttest using the N-Gain value. The value was then converted to the following criteria:

| | |
|---|---|
| $0.70 < N\text{-}Gain$ | High |
| $0.30 \leq N\text{-}Gain \leq 0.70$ | Moderate |
| $N\text{-}Gain < 0.30$ | Low |

(Hake, 1999).

Indicators of critical thinking skills include identifying problems, solving problems, and drawing conclusions. The identifying problems indicator is related to temperature and heat information gathering and problem understanding by students. The solving problems indicator applies the principles and analyzing the concepts of temperature and heat study materials while the drawing conclusions indicator is related to evaluating the resolution of temperature and heat problems.

The analysis of students' responses used Guttman data, whereas the percentage of student responses (R) was converted to criteria (Riduwan, 2010), as follows:

| | |
|---|---|
| $81\% \leq R \leq 100\%$ | Strongly Agree |
| $61\% \leq R < 81\%$ | Agree |
| $41\% \leq R < 61\%$ | Somewhat Agree |
| $21\% \leq R < 41\%$ | Disagree |
| $0\% \leq R < 21\%$ | Strongly Disagree |

Student responses are said to be effective if the student's positive response is in the category of agreeing and strongly agree.

The procedure for developing the Basic Physics learning set based on critical thinking skills using the Android platform Edmodo application followed the steps of the ADDIE model.

The analysis phase consists of needs analysis, analysis of student characteristics, and analysis of topics and assignments. Needs analysis includes problem identification, especially the process and assessment of Basic Physics course learning. Also, the curriculum

on Basic Physics course, especially the part of learning outcomes was analyzed. Moreover, the analysis of the development of technology and information as an alternative learning system for the higher education era of revolution 4.0 was performed. Also, there was also an analysis of student characteristics, including students' basic knowledge and skills. Furthermore, the analysis of the availability of information technology facilities and infrastructure at the school was conducted. Topic and task analysis include the factual, conceptual, principle, and procedural study materials on the temperature and heat theme as well as the determination of the problem-solving steps were performed.

The design phase included formulating and describing the learning objectives to achieve learning outcomes according to the hierarchy of factual learning objectives, procedural concepts from concrete to simple to complex. Also, it included the determination of learning strategies namely online collaborative learning methods and classroom learning. Also, it determined the delivery strategies based on student characteristics, information technology development, and classroom management, as well as strategy for assessment based on the objective of assessment.

The develop phase consisted of developing Basic Physics learning set including Semester Lesson Planning (SLP), Lecture Event Units (LEU), Basic Physics modules, critical thinking skills assessment sheets and students' response questionnaires. Moreover, Edmodo utilization is applied in this phase by creating the lecturer account and class group. Moreover, online learning was designed using this application at http://edmodo.com. Furthermore, this phase included the validation of Basic Physics learning set based on critical thinking skills by the lecturers of Science Education/Physics Education and learning media experts.

In the implementation phase, it included an application of Basic Physics learning on 16 students of Mathematics Education Study Program, Semester II Academic Year 2018 – 2019, STKIP PGRI Bangkalan. The design used in the trial was *One Group Pretest-Posttest Design*.

The evaluation phase consisted of evaluating the achievement level of the learning objectives (LO) of Basic Physics course and the response of students to the Basic Physics course learning set using the Android platform Edmodo application.

## RESULTS AND DISCUSSION

The development of this research used the ADDIE model procedure, intending to develop the Basic Physics learning set based on critical thinking skills using the Android platform Edmodo application.

### Analysis Phase

The results of the needs analysis phase on the student characteristics, topics, and tasks, such as identification of problems, potential, and achievement of learning in Basic Physics course. The problem of Basic Physics learning in this study was the assessment of the results of learning only measured the cognitive domain only.

Therefore, Basic Physics learning gave less meaning to the students. Learning by using the digital application is a form of the potential of college learning in the era of industrial revolution 4.0. In Indonesia, most of the students are familiar with the Android platform smartphone as a daily communication tool. Therefore, the Edmodo application that is available in the Android Play Store is easy for students to download and install it on their mobile phone. This application of e-learning using Edmodo supports the achievement of Basic Physics learning following the Indonesian National Qualifications Framework curriculum including mastering concepts, principles, and procedures and training the students' critical thinking skills in solving problems by utilizing the development of information technology.

### Design Phase

The results of the design phase were determining and sorting the objectives of Basic Physics course learning, especially on temperature and heat study material. The learning objectives of temperature and heat include 1) the concept mastery on the topic of temperature and heat by students through online discussion using the Edmodo application within one week, 2) students can apply the concepts and principles of temperature and heat to Physical problems without looking at books independently. This research also employed learning strategies using blended learning. Blended learning is a learning system that combines synchronous learning strategies directly in the classroom and asynchronous indirectly online classes. The online class was held a week before and after classroom learning. Online learning trained students to find information, online

discussions to resolve temperature and heat problems critically and responsibly by employing the Android platform Edmodo application. Assessment of learning objectives used cognitive assessment sheets and critical thinking skills assessment sheets.

**Develop Phase**

Developing Basic Physics learning tools, including Lesson Planning (SLP), Lecture Event Units (LEU), critical thinking skills assessment sheets, and student response questionnaires. At this phase, the Edmodo application account as a lecturer at http://edmodo.com was created. Next, the group (class of courses) and an online learning application for Edmodo were developed.

Figure 1 shows a screenshot of the main page of the Basic Physics course online class of the Edmodo application. Lecturers can post lecture information, questions, assignments and quizzes to students using the Edmodo application note, assignment, and quiz features.

Figure 2 shows a screenshot of SLP and LEU that were posted using the Edmodo application note feature by attaching SLP and LEU files.
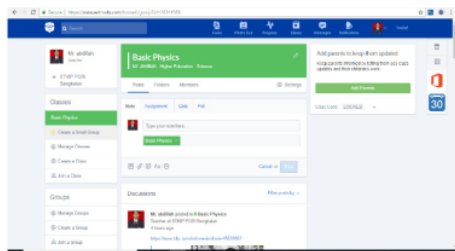


**Figure 1**. Screenshot of the main page of Edmodo application account



**Figure 2**. Screenshot of the SLP and LEU post on Edmodo



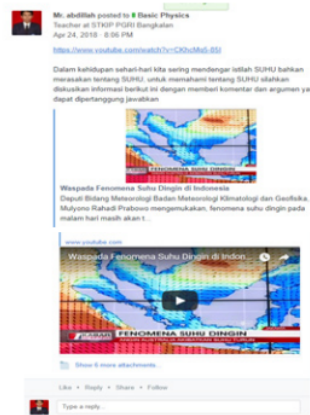**Figure 3**. Screenshot of the question post on Edmodo



**Figure 4**. Screenshot of information post on Edmodo

Figures 3 and 4 show screenshots of questions and up-to-date information about temperature and heat posted by the lecturer using the Edmodo application note feature by adding a website page link.



**Figure 5**. Students assignment plant (SAP)

**Figure 6**. Screenshot of SAP post on Edmodo

Figures 5 and 6 show Student Assignment Plans (SAP) and its post by lecturers using the Edmodo application assignment feature
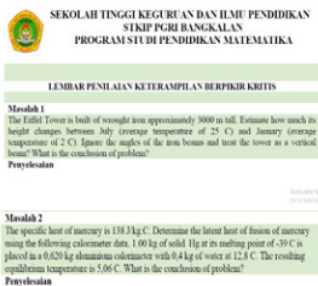


**Figure 7**. Assessment Sheet for Critical Thinking Skills

Figure 7 shows a critical thinking skills assessment sheet. Validation of Basic Physics learning set based on critical thinking skills by using the Android platform Edmodo application was done by the Science Education and Physics Education lecturers as well as the learning media experts. Table 1 shows that the results of the content validity assessment consist of aspects of the content, presentation, and language on average 3.5 having a valid category with 95% reliability.

Table 2 shows that the results of the expert validation on content, navigation, structure and design, structure and appearance, and authenticity (uniqueness) on average 3.5 have categories valid with 95% reliability.

The results of the validation assessment by experts state that Basic Physics learning set using the Android platform Edmodo application can be used with small revisions or without re-

visions.

**Implementation Phase**

The results of the implementation phase of the Basic Physics learning set based on critical thinking skills using the Android platform Edmodo application are shown in Figure 8.
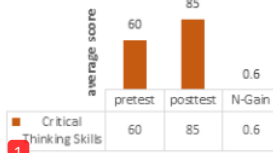


**Figure 8**. Results of Critical Thinking Skills assessment at Pretest and Posttest

Figure 8 shows that the average score of the results of critical thinking skills at the pretest and posttest has a significant increase that is having N-Gain 0.6 medium category. It can be concluded that the Basic Physics learning set can improve critical thinking skills.
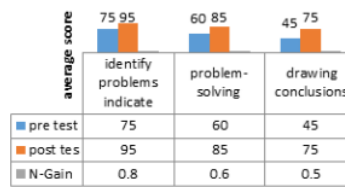


**Figure 9**. Results of Indicators of Critical Thinking Skills at Pretest and Posttest

Figure 9 shows that students' critical thinking skills experienced an increase as can be seen from the results of the pretest and posttest design. It is indicated by identifying problems with N-Gain 0.8 at the high category, whereas solving problems with N-Gain 0.6 at medium category and drawing conclusions with N-Gain 0.5 at medium category.

In this study, the indicators of critical thinking skills. i.e., to identify problems indicate the student's ability to determine the known variables and variables asked on temperature and heat problems. In online clasroom learning, students can comment on questions posted by lecturers by searching for information from the internet, processing information and adding links of information website pages as a reference source to support their answer. Then, they can post it on the Basic Physics group on the Edmodo application. Members of the Basic Physics group in Edmodo application provide comments and responses to the opinions of

**Table 1**. Results of Content Validation

| Aspect | Criteria | Average |
|---|---|---|
| Study material | Conformity of study material with the learning outcomes | |
| | Study material accuracy | |
| | Study material support | 3,4 |
| | Study material update | |
| Presentation | Presentation technique | |
| | Presentation support | |
| | Study material support | 3,5 |
| | Learning presentation | |
| | Presentation Completeness | |
| Language | Straightforward | |
| | Communicative | |
| | Interactive | 3,6 |
| | Compliance with Student Development Levels | |
| | Allegiance and Alignment of Thinking Flow | |

**Table 2**. Results of learning media expert validation

| Aspect | Criteria | Average |
|---|---|---|
| Content | Utility Of Content | |
| | Completeness Of Information | |
| | Subject Specialization | 3.7 |
| | Reliability Of Content | |
| | Sintax Of Content | |
| Navigation | Order Of Elements | |
| | Loading Speed | |
| | Site Mat | 3.4 |
| | Information Structure | |
| | Software Requirements | |
| | Browser Compatibility | |
| Structure dan Design | Convenience Of Navigation Tool | |
| | Identity Of Site | |
| | Links To Other Sites | 3.5 |
| | Ease Of Use Of Navigation Tools | |
| | Search Engine | |
| Appearance and Multimedia | Graphics Representation | |
| | Readability Of Content | 3.8 |
| | Multimedia | |
| Uniqueness | Uniqueness Of Content | |
| | Aesthetics Of Content Presentation | 3.3 |
| | Uniqueness Of Design characteristics | |

other group members. Therefore the online interactions occur. It trains students' critical thinking skills, such as collecting, interpreting, and analyzing information.

Indicators of critical thinking skills, i.e., problem-solving, where students can apply concepts and principles about energy conservation laws, phase changes, and energy equations. In online classroom learning using the Edmodo application, students can share information about solving temperature and heat problems independently. It is supported by the statement of guided inquiry-based learning in solving problems which can improve critical thinking skills (Nisa, Jatmiko, & Koestiari, 2018).

Indicators of critical thinking skills, i.e., drawing the conclusions where evaluating problem-solving by providing explanations by the concepts and principles of temperature and heat was also measured in this research.

The syntax of Basic Physics learning is based on critical thinking skills using the Edmodo application on the Android platform, which is blended learning. Collaboration between online and real classroom learning in this form of online classroom learning that was conducted a week before and after classroom learning. Online class learning using the Basic Physics group in Edmodo. The lecturer made an account as a lecturer on the Edmodo application. Then, lecturer made a Basic Physics group as an online class then students joined the group by a group code.

Phase 1: seeking information. Learning by an online class before classroom learning was initially conducted by lecturers where they uploaded SLP and LEU to the Basic Physics group in Edmodo. Then, the lecturer asked the students to download it. The lecturer posted questions about temperature and heat in the group and asked students to comment and respond critically and responsibly. Students could get online interactions in Edmodo where students could also search for information about temperature and heat from various sources on the internet then post their opinions along with the URL address link. The advantages of online interaction using the Edmodo application using Android include 1) increasing student confidence in giving comments and responses, and 2) students can follow comments and responses of group members both directly and indirectly. It is in line with the statement that online interactions can increase students' confidence in learning and can provide an independent learning experience (Tubaishat & Lansari, 2011). Online interaction makes students more confident in giving comments and responses; therefore when students are in the meeting at the classroom, they already have an initial knowledge about the material to be discussed by the lecturer (Zainudin, 2016). Online interaction lecturers know student learning activities and give students the opportunity to solve problems by giving comments and arguments (Coca & Slisko, 2013). By this study, the lecturer can recheck the validity, reliability, and accountability of information by checking the link address page of the source of the information source added in Edmodo.

Phase 2: acquisition of information. The lecturer uploaded temperature and heat problems to the Basic Physics group on the Edmodo application. Students solved temperature and heat problems then uploaded problem-solving solutions. In phase 2, students could conduct online discussions in the group to solve temperature and heat problems. Lecturers could give scaffolding (assisted learning) to students when experiencing difficulties. According to Vygotsky, students can study well when students can solve problems with students.

Phase 3: synthesizing of knowledge. Lecturers helped students to draw conclusions based on online discussions in the Basic Physics group of the Edmodo application.

Learning in classroom facilitates the lecturer to ask students for solving the temperature and heat problems in group. The lecturer can guide students to solve temperature and heat problems in groups. The effectiveness of the use of the first basic physics practice module based on guided inquiry is very significant to improve hard skills and soft skills of the students (Suprianto, Kholida, Andi, & Mahardika, 2018). The lecturer then checked the students' understanding by asking several students to present in front of the class.

Online class after direct classroom learning, i.e., lecturers uploaded the task to the Edmodo Basic Physics group and asked students to complete it. Lecturers can set the time when tasks can be downloaded and the deadline for uploading them. If students make a late submission, students cannot collect assignments. Lecturers can also see the progress of students who have submitted and who have not uploaded the tasks. Therefore, the lecturer can give warning (notification) to students. The results of the implementation of Basic Physics learning set based on critical thinking skills using Edmo-

**Table 3**. Students' feedback response

| Aspect | Percentage |
|---|---|
| Learning using the Android platform Edmodo application is flexible, practical, and fun. | 100 |
| Is learning using the Android platform Edmodo application can increase learning interest? | 84 |
| Is learning using the Android platform Edmodo application provides lecture information quickly to students? | 75 |
| Is learning using the Android platform Edmodo application makes it easy for students to discuss online? | 88 |
| Is learning using the Edmodo application on the Android platform can train the skills of the present century? | 87 |

do can improve students' critical thinking skills.

Table 3 shows that learning using the Android platform Edmodo application is flexible, easy to install, and practical in use, and 100% fun. Learning using the Android platform Edmodo application could increase learning interest by 84% and learning using the Android platform Edmodo application provided lecture information quickly to students 75%. Learning using the Android platform Edmodo application made it easy for students to discuss online 88%. Learning using the Android platform application Edmodo trained the skills of the present century at 87%.

## CONCLUSION

Based on the results of research and discussion it can be concluded that the Basic Physics learning set based on critical thinking skills using the Android platform Edmodo application had good quality criteria because it fulfilled the aspects of validity, practicality, and effectiveness. The average content validation results 3.5 has a valid category with 98% reliability, and the average learning media validation 3.5 has a valid category with 95% reliability. It can be said that the developed learning device can be used and reliable. Students' critical thinking skills at the pretest and posttest experienced a significant increase by N-Gain 0.6 at the medium category, and the results of student responses to positive learning can be said that learning set developed practical and useful.

Suggestions given based on the results of the research include 1). The lecturer can develop a learning set of Basic Physics course on another subtopic; 2). Lecturers can develop indicators of other critical thinking skills to de-termine essential skills of thinking more deeply; 3). Lecturers can apply at the next meeting on an ongoing basis to assess the reliability of learning set; 4). Quiz creator application can be used to create essay questions to train high-level thinking skills and plagiarism check application to check the similarity of student assignments to be uploaded.

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# Article 8

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