Development of a Problem Based Learning Oriented Movement System Module with a Computational Thinking Approach to Improve Students' Critical Thinking Skills

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Abstract

The development of a Problem Based Learning-oriented Movement System module with a Computational Thinking approach to improving students' critical thinking skills is one of the efforts to improve this pedagogic competency. The purpose of this research is to analyze the validation of problem-based learning-oriented motion system modules with a computational thinking approach to improve students' critical thinking skills and analyze the feasibility of problem-based learning-oriented motion system modules with a computational thinking approach to improve students' critical thinking skills. This study used a Research and Development (R & D) design and the technique used was a one-shot case study. The research was conducted at MAN Salatiga with 71 research subjects divided into 2 classes. The results of the study are as follows: (1) the assessment by material experts obtained 85.67%, and 76.5% with very good and good criteria, and the assessment by media experts obtained 90% and 92.00% with very good criteria so that the media declared valid. The value obtained from students who used the module and then worked on critical thinking questions obtained an average value of 92.69 after being analyzed based on the predetermined Minimum Mastery Criteria (KKM). KKM value determined namely 75. The test results showed 98.59% of students passed the very high category, so it can be stated that the use of the Movement System module oriented to Problem Based Learning with Computational Thinking is approachable to improve students' critical thinking skills.

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INTRODUCTION

According to Law No. 14 of 2005, there are 4 teacher competencies namely pedagogic competence, professional competence, personal competence, and social competence. Some matters relating to pedagogical competence include the application of learning models, learning methods, learning resources, strategies and approaches used during the learning process in the classroom, and so on. Student-centered or student-centered learning needs to be implemented so that learning objectives can be achieved optimally. The development of information and communication technology in the 4.0 era also requires teachers to immediately implement the 2013 curriculum that has been designed by the government. The 2013 curriculum mandates teachers to apply 6 C skills (Critical, Creative, Communicative, Collaboration, Compassion, and Computational Thinking) as well as higher-order thinking skills (HOTS). The Problem Based Learning model is one of the learning models mandated by the 2013 curriculum.

The problem-Based Learning model is Problem Based Learning Model or Problem Based Learning (PBL) is a learning model that uses real problems in everyday life as a learning context for students to think about critical thinking skills and problem-solving skills (Problem Solving) as well as to acquire knowledge, facts, principles, and concepts that are the essence of the subject matter while Computational Thinking (CT) is a problem-solving method based on informatic logic like a computer machine, namely formulating complex problems to be simple and can be solved quickly, effectively, efficient, communicative, and collaborative. There are four key techniques in Computational Thinking, namely Decomposition (breaking larger and more complex problems) into smaller or simpler parts, (Kawuri et al., 2019) The application of Computational Thinking (computational thinking) can improve students' critical thinking skills. Learning the Problem Based Learning model will motivate students to think critically because when learning the syntax conditions students to discuss issues related to everyday life in society. This was disclosed (Saputro & Rayahu, 2020) in their research on the differences between the Project Based Learning (PjBL) model and the Problem Based Learning (PBL) model on students' critical thinking skills, both of which affect students' critical thinking abilities.

Motion Systems is the material for Biology Class XI specializing in Science, this material discusses Motion Systems with the following basic competencies: Analyzing the relationship between the structure of the organ-composing tissue in the locomotion system concerning bioprocesses and functional disturbances that can occur in the human locomotion system. This material is more abstract and sometimes causes misconceptions, so it is difficult for students to understand, this is indicated by the low value of the Motion System Material which is always below the Minimum Competency Criteria (KKM) so there is a need for an appropriate learning model so that learning objectives can be achieved properly and able to improve student achievement.. The Problem Based Learning learning model with the Computational Thinking approach is tried to be applied in class so that the learning objectives of the motion system material can be achieved and also able to improve students' critical thinking skills(Paul & Elder, 2014)

METHOD

This research is research and development or Research and Development (R&D). Educational development research (R&D) is a process used to develop and validate educational products. The results of development research are not only the development of an existing product but also to find of knowledge or answers to practical problems(Borg and Gall). The process of learning activities is carried out by applying the Motion System Module oriented to Problem Based Learning with a Computational Thinking approach to improve students' critical thinking skills. The research aims to analyze the validity and feasibility of the Movement System module oriented to Problem Based Learning with the Computational Thinking approach to the Motion Systems material to improve the critical thinking skills of class XI MIPA students. The research was conducted at MAN Salatiga. The research was conducted at MAN Salatiga with 71 research subjects divided into 2 classes. Implementation technique used in this research is a one-shot case study.
Table 1. One Shot Case Study Model

<table>
<thead>
<tr>
<th>Experiment Class</th>
<th>The treatment given</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
<td>O</td>
</tr>
</tbody>
</table>

The validation of the Movement System Module has oriented to Problem Based Learning with a Computational Thinking approach to improving critical thinking skills and the feasibility test index value of teaching materials qualitatively according to Sugiyono (2015).

Table 2. Feasibility of teaching materials M-learning (Mobile Motion) android based

<table>
<thead>
<tr>
<th>No</th>
<th>range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>81.25% &lt; Validation Value ≤ 100%</td>
<td>Very valid</td>
</tr>
<tr>
<td>2</td>
<td>62.5% &lt; Validation Value ≤ 81.25 %</td>
<td>Valid</td>
</tr>
<tr>
<td>3</td>
<td>43.75% &lt; Validation Value ≤ 62.5%</td>
<td>Less valid</td>
</tr>
<tr>
<td>4</td>
<td>25% &lt; Validation Value ≤ 43.75%</td>
<td>Invalid</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

Critical thinking skills are one of the skills of the 21st century. These skills are skills mandated by the 2013 curriculum. Teachers as educators are the key to educational success. Pedagogic competence is one of the competencies that must be mastered by teachers. Pedagogic competence relates to the learning process in the classroom. Learning models, learning methods, strategies, and learning approaches must be understood by teachers so that learning objectives are easily achieved. The Problem Based Learning model is a learning model that can improve critical thinking skills (Criticize Creative, Collaboration, Communication, Compassion, and Computational Thinking / 6C). (Kawuri et al., 2019) (Darise, 2019).

The result of this research is the development of a Problem Based Learning-oriented Movement System module with a Computational Thinking approach containing motion system material by incorporating problems in everyday life that are solved through computational thinking (Computational Thinking) in the evaluation questions.

The front cover page (cover), introduction, glossary, and learning materials 1, 2, and 3 can be seen in the image below.

Figure 3. Concept map page

Figure 4. Introduction page

Figure 5. Example of Computational Thinking questions to improve critical thinking skills
The validation carried out by material experts aims to analyze the feasibility of the content of the material or content in the module so that the researcher gets input which will later be used as teaching material so that the developed module is better and feasible for teaching materials in biology learning.

**Table 3. Feasibility test of teaching materials by material experts**

<table>
<thead>
<tr>
<th>Validation</th>
<th>Presentation</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validators 1</td>
<td>85.6 %</td>
<td>Very Good (Valid)</td>
</tr>
<tr>
<td>Validators 2</td>
<td>76.5 %</td>
<td>Good (Valid)</td>
</tr>
</tbody>
</table>

The feasibility test of teaching materials was validated by 2 validators. Validation by material experts I got a presentation value of: 85.6% and validation from material experts II got a presentation value of: 76.5%, in a good category. This shows that the content of the material contained in the motion system module is oriented to Problem Based Learning with a Computational Thinking approach to improve critical thinking skills that can be used by students in the learning process.

The Movement System Module has oriented to Problem Based Learning with a Computational Thinking approach to improving critical thinking skills that are developed before being used and must be validated by media experts. Validation by media experts includes several indicators: Graphical Feasibility, media components, and Language Feasibility. The results of the validation by allh media are presented in table 4:

**Table 4. Feasibility test of teaching materials by Media Experts**

<table>
<thead>
<tr>
<th>Validation</th>
<th>Presentation</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Validators 1</td>
<td>93.9 %</td>
<td>Very Good (Valid)</td>
</tr>
<tr>
<td>Validators 2</td>
<td>92.8 %</td>
<td>Very Good (Valid)</td>
</tr>
</tbody>
</table>

Based on the validation results, the results of validation by media experts I get a presentation value: of 93.9%, and validation from media experts II get a presentation value: of 92.8%, this shows that the module developed has a high presentation, meaning that the module is very good or valid. PBL-oriented modules with the CT approach can be used by students because the aspects of graphic feasibility, learning media components, and language feasibility have been met. The results of the validation by the media experts above obtained an average score above 10, so if you look at the table of criteria, the PBL-oriented module with the CT approach is included in the "Decent" category.

Critical thinking ability tests are carried out by the way the researcher provides material in advance according to the indicators that must be achieved by students after completion, the researcher gives questions that refer to indicators of critical thinking ability, questions that are given to students in the form of computational thinking questions (CT) which later students can solve these problems according to indicators of critical thinking skills. The questions were given to 2 classes consisting of 71 students, the critical thinking skills given were in PBL oriented module with a CT approach so that students can solve problems by thinking computationally (CT)

**Table 5. Percentage of critical thinking skills test results**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed students</td>
<td>70</td>
<td>98.6%</td>
</tr>
<tr>
<td>Unfinished students</td>
<td>1</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

Based on table 5, the results of the critical thinking ability test show the suitability between the purpose of using the PBL-oriented motion system module with the CT approach and the learning objectives, which is shown by the student's completeness which is more than 75%, namely 98.6%. learners able to use mAnalyzing and solve problems encountered daily.

The use of the PBL-oriented motion system module with the CT approach to improving students' critical thinking skills has a very good effect as shown by the results of the percentage of students' completeness in working on critical thinking ability test questions.

This study has several limitations, starting from the limited number of samples, so researchers must use research methods that are suitable for the number of samples available. The implementation of the research was constrained because of school activities, namely the election of the OSIS chairman so the implementation of the pre-test and post-test was not conducive because the supervision of the
implementation of the test was not optimal. The next problem is that there are several inputs from the validator lecturer regarding the existence of a trigger question so that there is a case study of the problem that must be resolved.

CONCLUSION

Module eligibility problems-Based Learning-oriented motion system with a Computational Thinking approach to improving students’ critical thinking skills, media experts and material experts declared valid and suitable for the learning process in class XI by media experts

REFERENCES


Nomor: 1 Bulan Januari Tahun 2017

Halaman: 12—21


