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Practicality of Learning Devices Based on Conceptual Change Model to Improve Concept Mastery of Students in the Gas Kinetic Theory Material

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Abstract: This study aims to determine the practicality of learning devices based on conceptual change model to improve concept mastery of students in the gas kinetic theory material. The device was developed with a 4D model consisting of define, design, develop, and disseminate. The learning tools developed are in the form of syllabus, lesson plan, student worksheet, and concept mastery instrument. The data collection was carried out through the distribution of student response questionnaires and observation sheets on the implementation of learning in the eleventh grade MIPA SMAN 1 Kediri. The questionnaire score used consisted of 4 scales, namely a scale of 4 (very good), a scale of 3 (good), a scale of 2 (less), and a scale of 1 (very less). The results showed that the response of students and the implementation of learning were very practical. Based on these data, it can be concluded that the learning device conceptual change model practically to improve concept mastery of students in the gas kinetic theory material.

Keywords: Conceptual change model; Concept mastery; Learning device.

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Introduction

Physics is a subject from one of the branches of Natural Sciences which explains various kinds of natural phenomena in life. Natural phenomena can be explained by a concept, theory and physical law that can finally be accepted by the human mind (Hulwani et al, 2019; Hidayatin et al, 2022). Studying physics means seeking knowledge about nature and existing concepts, both concrete and abstract, studying laws, theories, principles, rules, and or formulas consisting of concepts based on the study process (Dewi et al, 2020; Hidayati et al, 2020).

Mastery of concepts and principles of physics is a prerequisite for successful learning of physics to continue to a higher level which can later be applied in everyday life (Muhaimin et al, 2015; Doyan et al, 2020; Harjono et al, 2020). Mastery of concepts and principles of physics will certainly be obtained through learning activities (Armiati et al, 2020, Gunawan et al, 2021; Aldi et al, 2022). Based on the impact of these competencies, understanding is a very basic element. This ability generally gets emphasis in the teaching and learning process (Yudiafarani et al, 2022). Students are required to understand or understand something being taught, to know something that is being communicated and to be able to take advantage of its content (Putra et al, 2014; Doyan et al, 2019; Ichtiari et al, 2022).

Based on the results of interviews and observations of researchers at SMA Negeri 1 Kediri, that there are problems in understanding students' concepts. This fact is supported by the learning that occurs in schools today,

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there are still many oriented efforts to develop and test students' memory. Learning still tends to be based on memorization theory and not based on student experience, so that students' abilities are simply understood as memorization abilities.

Students' understanding of physics concepts in depth requires a change in thinking patterns from applying conventional learning to innovative learning (Ichtiari et al, 2019; Nurmaya et al, 2021; Hajratun et al, 2022). Therefore, in science learning the teacher should be able to act as a guide-to-guide students in starting the learning process (Kartini et al, 2019; Khasanah et al, 2019, Susilawati et al, 2020). The Conceptual Change Learning Model is one of the learning models based on constructivism. The model is able to change students' misconceptions or intuitions into scientific concepts, increase students' understanding of concepts, and improve student learning outcomes (Putra et al, 2014).

Based on these considerations, the researchers developed a learning device based on conceptual change model to improve concept mastery of students in the gas kinetic theory material. In the process of developing this device, researchers tested the practicality of the device.

Method

This study aims to determine the practicality of learning devices based on conceptual change model to improve concept mastery of students in the gas kinetic theory material. The device was developed with a 4D model consisting of define, design, develop, and disseminate (Sugiyono, 2017). The define stage is carried out through observations and interviews with teachers to obtain information related to the problems faced in learning physics especially on the gas kinetic theory material (Susilawati et al, 2022). The design stage aims to produce an initial draft of learning tools, form of a syllabus, lesson plans, student worksheet, instruments concept mastery. Furthermore, validation of the developed device (develop stage) is carried out to determine the level of feasibility. The learning devices that were declared valid were then tested on a limited basis in the eleventh grade MIPA 1 SMAN 1 Kediri to determine the practicality of the device. The data collection was carried out through the distribution of student response questionnaires and learning implementation observation sheets. The questionnaire score used consists of 4 scales, namely a scale of 4 (very good), a scale of 3 (good), a scale of 2 (less), and a scale of 1 (very poor) (Setiyosari, 2014). Student responses and the implementation of learning were analyzed using equation 1.

$$\text{Practicality}(\%) = \frac{\text{Score earned}}{\text{Max score}} \times 100\% \qquad (1)$$

The average score of student responses in the form of percentages is then categorized into practicality criteria as presented in table 1. While the average score of learning implementation in the form of percentages is further categorized into practicality criteria as presented in table 2. Learning tools are said to be practical if the percentage of student responses and the implementation of learning are at least in the fairly practical criteria and good criteria (Santi et al, 2016).

Table 1: Practicality Criteria Based on Student Responses (Hodiyanto et al, 2020)

Percentage Value Range(%)	Criteria
80< score ≤100	Very Practical
61< score ≤80	Practical
41< score ≤60	Practical enough
21< score ≤40	Less Practical
0< score≤20	Not Practical

Table 2. Practicality Criteria Based on Implementation of Learning (Akbar, 2013)

Interval	Criteria
3,6 - 4,0	Very Good
2,6 -3,5	Good
1,6 – 2,5	Less
0, - 1,5	Very Less

Result and Discussion

The learning devices developed in this study were the syllabus, lesson plans, student worksheets, and concept mastery instruments that were tested in the eleventh grade MIPA 1 SMAN 1 Kediri. In this study, the practicality of the learning devices developed through student response questionnaires and learning implementation questionnaires was tested. Data were obtained from student responses and assessments of the implementation of learning carried out by observers when limited trials were carried out. The data on the results of the Student Response Analysis are shown in Table 3.

Table 3. Results of the Student Response Analysis

Product	Percentage	Criteria
Student worksheet	86.85%	Very Practical
Instruments concept mastery	84.02%	Very Practical

Based on Table 3 it can be seen that students respond both student worksheet and concept mastery test instruments were developed with each Student worksheet percentage of 86.85% and instruments concept mastery of 84.02%. Based on these results, it is presented that the learning device products developed are very practical to use in learning.

Furthermore, the analysis of the implementation of learning aims to determine the practicality of learning devices through direct observation by the observer.

During the learning process, the observer assesses the ability of a teacher/researcher in teaching and managing learning and student activities by filling in the statement items that have been prepared in the observation sheet in accordance with the prepared lesson plans. There are 3 observers involved in analyzing the implementation of learning, namely 1 physics teacher at SMAN 1 Kediri, and 2 fellow researchers. The assessment used is an observation sheet on the implementation of learning for 3 meetings. The results of the analysis of the implementation of learning can be seen in Table 4.

Table 4. Learning Implementation Analysis Results

Meeting	Average value	Criteria
1	3.7	Very Practical
2	3.6	Very Practical
3	3.7	Very Practical

Based on Table 4, it can be seen that the value obtained from the results of the analysis of the implementation of learning is averaged 3.6 with very practical criteria. These results indicate that the learning carried out has taken place according to the plan contained in the lesson plan. Qualitative data obtained in the form of suggestions and input from students and observers become improvements for the learning tools made.

Based on these results, it can be seen that the use of learning devices based on the conceptual change model is very practical in increasing students' mastery of concepts in the gas kinetic theory material. This is because teachers and students find it easy to carry out learning using these devices (Doyan et al, 2020; Susilawati et al, 2021). In addition, the use of the conceptual change can increase students' mastery of concepts, because the model can consider the prior knowledge possessed by students and how students relate this initial knowledge to the new knowledge provided (Baser et al, 2016).

Conclusion

Learning devices based on the conceptual change model are very practical to improve concept mastery of students in the gas kinetic theory material. This is because teachers and students find it easy to carry out learning using these devices. In addition, the conceptual change can improve mastery concepts of student, because the model can consider the initial knowledge that students have and how students relate this initial knowledge to the new knowledge provided.

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