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# Does Using Sigil E-Modules Impact High School Students' Knowledge and Curiosity? A Quantitative Analysis

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***Abstract***. This classroom action research has a purpose : (1) Implementing the sigil e-module to increase the knowledge competence of class XI MIPA 5 students at SMA Negeri Kebakkramat for the 2021/2022 Academic Year on temperature, heat, and heat transfer, (2) Implementing the sigil e-module to increase the curiosity of class XI MIPA 5 students at SMA Negeri Kebakkramat for the 2021/2022 academic year on temperature, heat, and heat transfer. The research model used is the model developed by Kemmis and Mc. Taggart went through two cycles. Data collection techniques in this study used observation, questionnaires, tests, interviews, and document review with data analysis techniques in the form of quantitative and qualitative analysis. The results of the study show that the application of a scientific-based sigil e-module to the material temperature, heat, and heat transfer can increase the competence of knowledge and curiosity of class XI MIPA 5 students at SMA Negeri Kebakkramat 2021/2022 Academic Year. The percentage of knowledge competence mastery increased from 33.33% in the pre-cycle to 69.44% in cycle I and increased again to 80.56% in cycle II. The achievement percentage of students' curiosity in the very good and good category increased from 15.38% in the pre-cycle to 80.56% in cycle I and again to 94.44% in cycle II. This research can be the basis for developing Sigil e-module to Temperature, Heat, and Heat Transfer material.

**Keywords:** Curiosity; e-module; scientific; Sigil



## INTRODUCTION

Education is learning and developing one's potential based on the curriculum. This definition aligns with the definition of the curriculum in the National Education System Law No. 20 of 2003, which is a collection of plans and rules of objectives, content, and teaching materials, including guidelines for the learning process to achieve the objectives of education. Knowledge, values, and skills, both outside and inside the school, are the transmission and transformation of education that lasts a lifetime (Siswoyo, 2013 in Fauzi et al., 2017). A quality national education system influences success in educating the nation's life (Nurkholis, 2013).

One of the branches of science is physics. Physics is defined as the science of natural phenomena and the interactions that exist in them (Mujizatullah, 2018). Physics is one of the foundations of science because studying natural sciences such as biology, chemistry, geology, or others must follow the laws

of physics. Physical science has benefits in helping humans because it is related to the phenomena of everyday life (Harefa, 2019).

Physics as a school subject can explain natural phenomena through laws, theories, and concepts included in human thinking. Learning physics means understanding the concepts that occur in natural phenomena. In many high schools, physics concepts are only taught to the level of abstract thinking. Concept understanding is an essential aspect of the learning process that involves abstract thinking (Kaniawati, 2017). The material of temperature, heat, and heat transfer, which is one of the physics materials in class XI, is considered difficult for students. According to Sözbilir (2003) and Winarti & Budiarti (2020), the concepts of temperature and heat materials are too abstract, making it difficult for students to learn them. Students' ability to master the concepts of temperature, heat, and heat transfer material is still relatively low. Namely, only 54.8% of students correctly understand the concepts (Sundari, 2019). This research indicates that students still face difficulties solving problems related to this material. In this material, many sub-materials require accurate learning modeling to add to the learning experience and understanding of the concepts that students learn.

Learning aims to enable students' attitudes, knowledge, creativity, skills, curiosity, and cooperation to be balanced and developed. To achieve educational goals, students must be curious about the concepts being taught. Curiosity is essential so that student's knowledge and experience can develop. Curiosity can create an active learning process to increase students' knowledge and competence. However, there are still many cases where the teacher acts as the center of the learning process (teacher-centered learning), where students only absorb the teacher's knowledge and do not try to find more information related to what they learn (Sari, 2016).

These learning problems also occur at SMA Negeri Kebakkramat in class XI MIPA 5 for the 2021/2022 academic year. According to observations and interviews with teachers and several students in class XI MIPA 5 SMA Negeri Kebakkramat, the learning process still uses conventional methods, such as lectures and assignments. Then, the learning process is also teacher-centered. When the learning process is online, the teacher uses learning media that is less interactive because it only uses reading material in PDF format in written form. The online learning process makes students uninterested in participating in learning activities, and they need help understanding abstract physics concepts such as heat, heat transfer, and temperature. The initial observation during offline learning shows that students' curiosity about learning materials is still relatively low. The percentage of initial observations showed that students who had very good and good curiosity categories were only 15.38%. The research has proven that students who rarely ask questions are silent when instructed by the teacher to ask, rely only on information from the teacher, and, when faced with problems they do not understand, students are just silent. In addition, the average score of students from the end-of-semester assessment results is still low. Based on the results of the end-of-semester assessment, 66.67% of all students scored below the minimum passing criteria of 70.

Learning approaches influence students' knowledge competence and curiosity. The scientific approach is one of the learning approaches that can increase students' curiosity. The scientific approach is a student-centered learning approach. Research conducted by Putra (2020) explains that scientific-based learning can improve learning outcomes and student curiosity. Scientific-based learning not only views the value obtained by students as the final result but also views the importance of the learning process. According to Annisa (2018), the learning process using a scientific approach will result in better student learning outcomes than with conventional approaches.

In addition to the right approach, student-focused teaching media is also needed to support learning success. One of the practical teaching media with the times is the electronic module (e-module) (Munandar et al., 2021). One of the software to create electronic modules is Sigil software. This software has advantages compared to other software, namely the command to insert audio and video files, can be used on all screen device sizes, can be used on PCs and smartphones so that it can make it easier to package material in the form of an electronic module learning media ('Aisy et al., 2020). Ulfa and Sucahyo (2022) state that sigil e-modules make learning less tedious and more enjoyable. Therefore, applying sigil e-modules in learning can increase students' curiosity about the concepts they learn. Munandar et al.'s research (2021) shows that using sigil e-modules in learning can improve student

learning outcomes. In addition, another study by Nehru and Irianti (2020) explained that increased curiosity in students can lead to increased learning outcomes.

Based on the above review, the researcher provides a solution so that the competence of knowledge and curiosity of students can increase by conducting a study entitled "Does Using Sigil E-Modules Impact High School Students' Knowledge and Curiosity? A Quantitative Analysis".

## METHOD

The subjects used in this study were students of XI MIPA 5 SMA Negeri Kebakkramat in the 2021/2022 academic year, totaling 36 students. This class action research applies the model developed by Kemmis and Mc. Taggart. Data was collected using several techniques, namely observation, questionnaires, interviews, and document reviews. Meanwhile, data analysis techniques in this study used quantitative and qualitative analysis.

The achievement indicator is declared successful if the number of students ≥ 75% of the total who take the test has reached the minimum passing criteria of 70 and the number of students ≥ 75% of students have achieved a score with a very good and good curiosity category according to Table 1.

**Table 1.** Criteria for Achievement of Student Curiosity

| Interval Score of Curiosity | Categorization |
|---|---|
| $X > Mi + 1{,}5\ Sbi$ | Very High |
| $Mi + 0{,}5\ Sbi < X \leq Mi + 1{,}5\ Sbi$ | High |
| $Mi - 0{,}5\ Sbi < X \leq Mi + 0{,}5\ Sbi$ | Medium |
| $Mi - 1{,}5\ Sbi < X \leq Mi - 1{,}5\ Sbi$ | Low |
| $X \leq Mi - 1{,}5\ Sbi$ | Very Low |

Source: Azwar, 2015.

description:

X = Respondent's score

Mi = Ideal mean

Sbi = Ideal standard deviation

## RESULT AND DISCUSSION

### RESULTS

The pre-cycle stage is to obtain initial data so that the problems found in the classroom are known. The techniques used in this stage are observation, questionnaire distribution, interviews, and document review. In the pre-cycle stage, initial observations and the results showed that the offline learning process was still teacher-centered learning using conventional methods, namely lectures and assignments. As a result, many students tended to be passive in participating in learning. In online learning, the teacher distributes pdf modules and assignments to students without explaining them first. The teacher's lack of engagement in scientific activities throughout the observation resulted in the absence of any observation of the science process. Table 2 shows the results of the observation of student curiosity at the pre-cycle stage.

**Table 2.** Results of Student Curiosity Based on Pre-Cycle Observation

| Interval Score of Curiosity | Curiosity Category | Total Students | Percentage |
|---|---|---|---|
| $X > 9{,}75$ | Very High | - | 0,00% |
| $7{,}58 < X \leq 9{,}75$ | High | 2 | 15,38% |
| $5{,}42 < X \leq 7{,}58$ | Medium | 10 | 27,78% |
| $3{,}25 < X \leq 5{,}42$ | Low | 20 | 55,56% |
| $X \leq 3{,}25$ | Very Low | 4 | 11,11% |

The observation results show that students with very good and good curiosity categories are only two people, so the curiosity of students is still low. This statement aligns with the results of questionnaires and interviews with teachers and students. The document review results from the end-of-semester assessment results determined the percentage of students who completed 33.33%. Table 3 shows data on student knowledge competency at the pre-cycle stage.

**Table 3.** Pre-cycle Student Knowledge Competency

| Data | Pre Cycle |
|---|---|
| Average score | 55,42 |
| Percentage passsing | 33,33% |
| Percentage no passing | 66,67% |

The execution of cycle I consisted of three meetings: the first meeting was held online, and the second and third were conducted offline. These sessions were divided into four stages:

***Planning of cycle I***

Researchers and teachers discussed learning scenarios, made lesson plans, compiled research instruments, and determined success targets.

***Implementation of the cycle I***

Implement the process of acquiring knowledge by utilizing the scientific-based sigil e-module, which consists of introductory, main, and concluding activities. A comprehensive assessment was done after the cycle, and a questionnaire to gauge student curiosity was distributed.

***Observation of cycle I***

According to the knowledge competency test results in cycle I, the results were obtained, as shown in Table 4.

**Table 4.** Knowledge Competency of Students, Cycle I

| Data | Pre Cycle |
|---|---|
| Average score | 74,03 |
| Percentage passsing | 69,44% |
| Percentage tidak passing | 30,56% |

Table 5 shows the results of the observation of students' curiosity in cycle I.

**Table 5.** Results of Student Curiosity Based on Cycle I Observation

| Interval Score of Curiosity | Curiosity Category | Total Students | Percentage |
|---|---|---|---|
| $X > 9,75$ | Very High | 22 | 61,11% |
| $7,58 < X \leq 9,75$ | High | 7 | 19,44% |
| $5,42 < X \leq 7,58$ | Medium | 5 | 13,89% |
| $3,25 < X \leq 5,42$ | Low | 1 | 2,78% |
| $X \leq 3,25$ | Very Low | 1 | 2,78% |

***Reflection of the Cycle I***

From the end of the cycle I, it was seen that there was an increase in students' knowledge competence and curiosity compared to the pre-cycle stage. However, students' knowledge competence results have not yet reached the predetermined research targets. Meanwhile, the results of observations of student curiosity have reached the research target. For knowledge competence to reach the research target and student curiosity to develop from cycle I, it is necessary to improve by continuing to the next cycle. The causes of not achieving the research targets in cycle I were: (1) some students still had difficulties accessing the sigil e-module when online learning took place. (2) Students cannot save answers directly in the sigil e-module. (3) Some students have yet to download the sigil e-module because the cellphone storage is full. (4) Time constraints resulted in no-question practice sessions. (5)

Learning was done quickly due to the need for more learning hours. (6) In the implementation of offline learning, it was seen that some students were less active when participating in learning. (7) Some students were late for class. (8) some students left the class and returned at the end of the lesson.

Based on the results of the reflection of cycle I, an improvement plan was carried out in cycle II, among others: (1) Provide direction and assistance to students who have difficulty accessing the sigil electronic module. (2) Provide printouts of LKS instead of e-modules to students to make writing and saving answers easier. (3) Manage the allocation of learning hours to be more effective so that they can add practice questions. (4) Motivate and stimulate students to be more active during learning. (5) Reconfirming the schedule for the start of physics learning to students so that they are ready to receive learning according to the lesson schedule.

The implementation of cycle II was carried out three times offline meetings through four stages, namely:

***Planning of Cycle II***

Researchers and teachers discussed learning scenarios, made lesson plans, compiled research instruments, and determined the target of research success by considering the reflections from cycle I.

***Implementation of cycle II***

Carry out the learning process by applying the scientific-based sigil e-module, which includes introduction, core activities, and closing. A comprehensive assessment was conducted after the cycle, and a questionnaire to gauge student curiosity was analyzed.

***Observation of Cycle II***

Table 6 shows the results of the knowledge competency test in cycle II. Based on observation data on student curiosity during the learning process of cycle II, the results are shown in Table 7.

**Table 6.** Students' Knowledge Competency Cycle II

| Data | Pre Cycle |
|---|---|
| Average score | 76,11 |
| Percentage passsing | 80,56 % |
| Percentage tidak passing | 19,44 % |

**Table 7.** Results of Student Curiosity Based on Cycle II Observation

| Interval Score of Curiosity | Curiosity Category | Total Students | Percentage |
|---|---|---|---|
| $X > 9,75$ | Very High | 27 | 75,00% |
| $7,58 < X \leq 9,75$ | High | 7 | 19,44% |
| $5,42 < X \leq 7,58$ | Medium | 1 | 2,78% |
| $3,25 < X \leq 5,42$ | Low | 1 | 2,78% |
| $X \leq 3,25$ | Very Low | - | 0,00% |

***Reflection of cycle II***

From the end of cycle II, students' knowledge competence and curiosity have reached the research target. The students' knowledge competence results showed that students who completed cycle II reached ≥ 75%. While the percentage of student curiosity categorized as very good and good in cycle II has reached ≥ 75%. Based on the results of cycle II, so the conclution is classroom action research has successfully achieved the research target to stop the cycle.

## DISCUSSION

The class action research used the scientific-based sigil e-module on temperature, heat, and heat transfer material in class XI MIPA 5 SMA Negeri Kebakkramat in the 2021/2022 academic year. This research is conducted in two cycles consisting of four stages: action planning, implementation, observation, and reflection. This PTK resulted in two findings. Namely, applying scientific-based sigil e-modules can increase the competence of knowledge (cognitive) and curiosity of students in class XI MIPA 5. School policies implemented this class action during the COVID-19 period. The

implementation of actions in cycle I was carried out online with the help of e-learning, namely WhatsApp and Google Meeting at the first meeting and offline with a capacity of 50% of students per session. At the same time, the implementation of actions in cycle II was carried out offline with a capacity of 100%.

Document review results from the end of the odd semester assessment measured students' knowledge competency at the pre-cycle stage. In contrast, at the end of each cycle, it was measured by the evaluation test results. Students' knowledge competence increased significantly from the percentage of students who completed the pre-cycle stage of 33.33% with an average score of 55.42 to 69.44% with an average score of 74.03 at the cycle I stage. The increase in the percentage of completed students in cycle I has yet to reach the predetermined research target, so it needs to be next cycle II. Based on the evaluation test results at the end of cycle II, students' knowledge competence has reached the research target with a percentage of complete students of 80.56% with an average score of 76.11.

Based on the results of curiosity observations and student interviews, it was found that the application of sigil e-modules increased students' knowledge competence and curiosity. The curiosity of students in the pre-cycle stage to cycle I increased significantly, namely from the percentage of students who had curiosity categorized as very good and good at the pre-cycle stage of 15.38% increased to 80.56% at the cycle I stage. The increase in the percentage of student curiosity has reached the predetermined research target. For students' curiosity to develop again from the previous cycle, the observation of students' curiosity continued at the second cycle stage. The results of the percentage of student curiosity categorized as very good and good at the second cycle stage amounted to 94.44%. In addition to applying scientific-based sigil e-modules, increasing student curiosity is also influenced by other factors, such as the learning strategies used by researchers and teachers.

Several obstacles occurred at the first cycle stage, so the researcher and teacher discussed improving the next cycle's learning implementation. Some obstacles included students still having difficulty accessing the sigil e-module during online learning. As a result, students fell behind in learning. In addition, some students have yet to download the Sigil e-module because the cellphone storage is full. Time constraints resulted in no-question practice sessions. Learning was carried out quickly due to the need for more learning hours. Some students were less active in the implementation of online and offline learning. Some students were late for class. In addition, in the second meeting, some students left the class and did not return until the end of the lesson. Improvements in cycle II resulted in better results; this was done in the planning stage of cycle II, which referred to the problems that occurred in the previous cycle. In cycle II, there was an increase in knowledge competence and student curiosity.

Learning media applied during the physics learning process uses varied content such as learning videos, modules, and interactive learning. This learning media can also be done by applying a scientific-based sigil e-module that several researchers have previously done. Several approaches can apply to learning, including the scientific approach. The scientific approach is a learning approach that can increase students' curiosity. The application of scientific-based sigil e-modules can stimulate students to actively build knowledge through concepts, laws, or principles of physics. The role of curiosity in students can provide stimuli that will trigger students to continue to try to find out or learn knowledge from all available learning resources. With this curious attitude, students will become more active in solving and finding ways to solve every problem they find.

Research conducted by Putra (2020) explains that science-based learning can improve learning outcomes and student curiosity. In addition, previous research reveals that using sigil e-modules is more effective and can improve student learning outcomes during COVID-19 (Munandar et al., 2021). According to Ulfa & Sucahyo (2022), e-modules with sigil applications can make learning more exciting and not look boring. Therefore, e-modules can increase students' curiosity about the concepts learned. Another study by Nehru and Irianti (2020) explained that increasing curiosity improves student learning outcomes. In line with this, applying scientific-based sigil e-modules in class XI MIPA 5 SMA Negeri Kebakkramat also shows similar results.

The teacher and student interviews resulted in several points, namely that some students experienced obstacles in using the sigil e-module. Some students still do not understand the concepts taught because they are not used to finding them themselves. Students also find working on knowledge

competency test questions challenging due to a lack of accuracy in working and not maximizing learning. In addition, students also felt that their curiosity increased after the application of sigil e-modules in learning. The sigil e-module contains phenomena, videos, and practice questions so that with this, students become enthusiastic during learning and are interested in the concepts they learn. This explanation shows that sigil e-modules have a positive influence on physics learning.

Based on the research findings and discussion above, it is concluded that applying the scientific-based sigil e-module in this class action research was declared successful. Students' knowledge, competence, and curiosity have reached the predetermined research targets. Therefore, applying scientific-based sigil e-modules can improve the competence of knowledge and curiosity of students in class XI MIPA 5 SMA Negeri Kebakkramat in the 2021/2022 academic year on temperature, heat, and heat transfer.

## CONCLUSION

Based on the discussion, it is concluded that: (1) The application of scientific-based sigil e-modules in learning can improve the knowledge competence of students in class XI MIPA 5 SMA Negeri Kebakkramat in the 2021/2022 academic year on temperature, heat, and heat transfer. The percentage of students' knowledge competency completeness increased from 33.33% at the pre-cycle stage to 69.44% at the cycle I stage and increased again at the cycle II stage to reach 80.56%. (2) The application of the scientific-based sigil e-module in learning can increase the curiosity of students in class XI MIPA 5 SMA Negeri Kebakkramat in the 2021/2022 academic year on the subject of temperature, heat, and heat transfer. The curiosity achievement percentage of students with very good and good categories increased from 15.38% in the pre-cycle stage to 80.56% in cycle I and increased again to 94.44% in cycle II.

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