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Improve the Motivation and Science Process Skills through the Application of the ARIAS Learning Model Assisted by PhET

Nilma Sutri[1], Azhar[1*], Nur Islami[1]

[1] Master of Physics Education, Universitas Riau, Indonesia.

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Corresponding Author:
Azhar
azhar@lecturer.unri.ac.id

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Abstract: The purpose of this study was to determine the activities of teachers and students during the application of the ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation, and to determine the increase in motivation and skills of students ' science process after the application of the ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation in students of SMA Negeri 1 Kampar Timur. This type of research is Class Action Research (PTK) on Physics subjects conducted in two cycles. The subjects of this study were students of Class XII MIPA 4 SMA Negeri 1 Kampar Timur with a total of 34 students. Data collection was carried out using the results of observation sheets of teacher and student activities, motivation questionnaires, and tests on science process skills. The results showed that there was an increase in the activity of teachers and students in cycle I to Cycle II after the application of the ARIAS learning model (Assurance, Relevance, Interest, Assessment, Satisfaction) assisted by PhET simulation. The results showed that the learning model ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) assisted by PhET simulation in students of Class XII MIPA 4 SMA Negeri 1 Kampar Timur can increase the motivation and skills of students' science process.

Keywords: ARIAS; PhET Simulation; Motivation; Science Process skills

Introduction

Education is directed to develop the potential and skills of students that can be used in living life in society, nation, and state (Reimers & Chung, 2019; Sartika et al., 2018). One of the expected skills is science process skills (Elvanisi et al., 2018). Science process skills are one of the most used thinking skills (Darmaji et al., 2022; Gültekin & Altun, 2022). Any individual who cannot use science process skills will have difficulties in everyday life, because these skills are not only used during education, but also used in everyday life (Waruwu et al., 2023). The development of science process skills allows students to gain the skills necessary to solve everyday problems (Danis et al., 2015; Kurniawan et al., 2019). Science process skills are key in students' academic achievement (Fitriana et al., 2021).

Motivation to learn is the overall driving force within the learners that gives rise to learning activities (Wawan & Pamungkas, 2021), which ensures the continuity of learning activities and gives direction to learning activities, so that the desired activity is achieved (Hasanah et al., 2017). High learning motivation possessed by learners will have a good impact on the learners themselves (Nopitalia et al., 2017).

Based on the results of observations at SMAN 1 East kampar teaching and learning activities are still watching, teachers explain the material, students take notes and then work on the problems. Students feel bored and bored in following a subject, especially in Physics subjects, this is due to the lack of variations in learning methods undertaken by teachers. The learning method applied is only the method of the teacher center which is a conventional method in the school. Students find it difficult to understand the context of abstract physics and it turns out that students very rarely

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conduct experiments in the process of learning physics. So far, students only use package books in the teaching and learning process in class. Situations like this can to some extent affect the interest of students to be provoked in learning, so that the motivation and expectations of students to learn more about the subject of physics itself will have an influence on student learning interests (Arista & Fitra, 2013; Kalender et al., 2019). With high motivation to learn, students will strictly follow the lessons in class, diligently read references, take notes material, review, remember, and be able to think deeply about the material that they get. Once at home, students will learn more regularly and purposefully (Hadi, 2020).

The ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning Model starts from cognitive theory and Constructivist theory that emphasizes concept learning as an active information processing, ending in exploration and discovery (inquiry) (Aprilyani & Hakim, 2020; Swastika & Narendra, 2019). The advantages of the ARIAS learning model (Assurance, Relevance, Interest, Assessment, Satisfaction) are to train students to be more confident, have a clear direction and goals and there are benefits to encouraging individuals to achieve these goals. While the weaknesses of the ARIAS learning model (Assurance, Relevance, Interest, Assessment, Satisfaction) are students who are lazy or difficult to learn independently and sometimes difficult to remember (Apiah, 2020).

In addition to the use of appropriate models, Learning media is something that is no less important in learning activities (Norazlina et al., 2022). One of the Learning media that can be used to support the physics learning process is PhET simulation media (Zulkifli et al., 2022). Physics Education Technology (PhET) is an interactive simulation of research-based physical phenomena that can support interactive and Constructivist approaches, provide feedback and convey messages or information in physics learning (Saputra et al., 2020). The advantages of PhET simulation is that it can conduct experiments ideally, which cannot be used using real tools and materials (Fithriani et al., 2016).

The learning process by using simulation media can be applied to each individual student because the activities tend to be fun, motivate students to do something and generate positive responses among students; can allow the development of learning through experimentation without real circumstances so as to reduce abstract learning materials and can train intensive communication between students with only a little guidance (Gusmida et al., 2016).

Method

The type of research used is class action research (PTK). According to Arikunto (2019), class action research is a reflection of learning activities in the form of an action, which is deliberately raised and occurs in a class together. Researchers use a research cycle that includes four stages in carrying out action research. Arikunto (2019) mentioned the stages are (1) planning, (2) implementation, (3) observation, and (4) reflection. the research procedure can be seen in Figure 1.

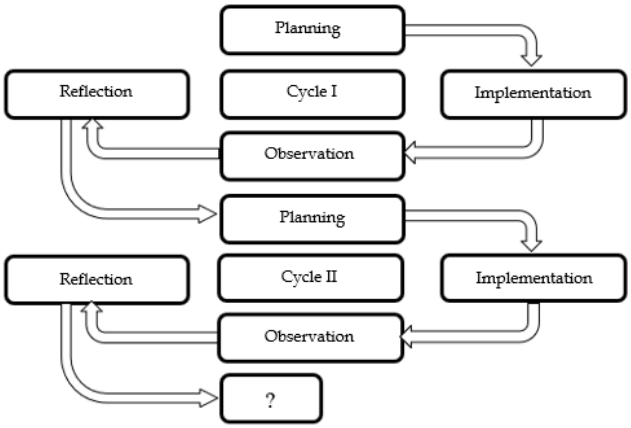

Figure 1. Class Action Research Procedure

The subjects of this study were students of Class XII MIPA 4 SMAN 1 Kaampar Timur. Students of Class XII MIPA 4 amounted to 33 students consisting of 14 male students and 20 female students. The selection of Class XII MIPA 4 is because according to the results of observation and initial analysis among Class XII MIPA 1 – XII MPA 6, Class XII MIPA 4 is the one who has low motivation of science process skills. Researchers used 2 research cycles covering four stages in carrying out action research. Suharsimi (2014) mentioned the stages are planning, implementation, observation, and reflection (Nazari, 2022). The purpose of this class action research is to improve motivation and science process skills.

Data collection was conducted through observation, questionnaires, and assessment tests. The data collection instruments used are observation sheet of teacher activity in teaching, observation sheet of student activity in learning, student motivation questionnaire, learning tools (syllabus, learning implementation plan, and worksheet of students). Testing of data analysis techniques using qualitative data that is descriptive statistical analysis in the percentage of each cycle to calculate the results of student and teacher activities, motivation and skills of the science process.

Result and Discussion

The process carried out in cycle I consists of planning, implementation, observation, and reflection. This study begins refers to the initial analysis conducted by researchers based on the results of observations and interviews. The results of interviews and observations of teachers who teach at SMA Negeri 1 Kampar Timur give the result that the learning process at SMA Negeri 1 Kampar Timur is still centered on the Teacher (teacher center). Although the current curriculum is applied curriculum 2013, but the implementation of the teaching and learning process still does not reflect the objectives of the curriculum 2013.

In the planning phase of cycle I, the researchers prepared learning instruments used in supporting the learning process using the ARIAS learning model assisted by PhET simulation. The learning instruments used include physics learning syllabus, learning implementation plan, worksheets for students, written test of learning outcomes, teacher and student activity observation sheets. The learning materials used in the first cycle are electromagnetic induction physics materials for three meetings with an allocation of 2 x 45 minutes for each meeting. The research instruments used previously have been consulted and through a validation process by expert lecturers so that they are feasible to use in research.

The implementation of class action research begins by providing pretests to students to determine students' initial science process skills. Pretest implementation is done by giving questions about electromagnetic induction material to students. The implementation phase of the implementation of the ARIAS learning model (Assurance, Relevance, Interest, Assessment, Satisfaction) will be carried out in three stages, namely initial activities, core activities, and final activities (Prameswari, 2019).

The initial or preliminary activity stage will include three elements of the ARIAS learning model, namely assurance, relevance, and interest (Salamah, 2019). At this stage, the teacher begins learning by giving a pretest and conveying apperception to students. Then the teacher provides motivation to students and instill confidence in students in following the learning process.

The core learning activities contain elements of the ARIAS learning model, namely assessment. Where at this core stage, the teacher will divide the students into several groups. This study group division aims to motivate students to take an active role in the teaching and learning process by discussing with each other for problem solving and can collaborate between group members. After finishing with the division of groups, then the teacher will ask each group to open a virtual simulation experiment PhET "Faraday electromagnetic Laboratory". After that, the teacher asked each group of students to conduct a virtual experiment and share the students' worksheet I as a student worksheet later.

In the closing activity of learning, the teacher will provide a written test to see the mastery of science process skills of students on electromagnetic induction material. Then the teacher and students will jointly create a resume with the teacher's guidance on important points that arise in learning activities about electromagnetic induction materials. Along with this, the teacher will also provide strengthening of understanding of the material provided.

The third stage in the first cycle of class action research is observation. During the learning process, the data collection in the form of observations made by the teacher along with the teacher observer who observed directly the teacher's activities to determine the success of the teacher in applying the ARIAS learning model. Student activity is also observed by the observer teacher. It aims to determine the activeness of students in the teaching and learning process by applying the ARIAS learning model. Observation of the first cycle of action is to observe the activity of teachers in teaching, student activity in learning, student motivation, and skills of students ' science process.

From the observation of teacher activity in teaching obtained the result that the average percentage of teacher activity in teaching in the first cycle is 77.5% which is in the good category. Based on this value, it can be seen that the teacher's activity has been quite successful and still needs to be improved again in the second cycle. While the results of student activity in learning on the implementation of the action cycle I electromagnetic induction material is 53.21% by including in the category of good enough. Then, for the results of student's motivation in the first cycle, resulting in that the motivation of students in the first cycle is 62.55%. The level of motivation of students in the first cycle is in a strong Category. This shows that the learning model applied has a good influence to increase student motivation in learning physics. Observation of science process skills to obtain the results of the assessment of students' science process skills on electromagnetic induction materials using PhET simulation learning media showed that of a total of 33 students of Class XII MIPA 4, 20 students completed and 13 students declared incomplete. With an average score of 73.80. As for the percentage of students ' completeness is 60.61%. This result has increased compared to the pre-cycle phase. However, the completeness of student learning outcomes is still below the value of 80% for the good category so that improvements are needed in the second cycle to improve the completeness of student

learning outcomes. Then, from the results of manual calculations obtained N-Gain Score with an average of 0.22 so that the improvement of student learning outcomes can be categorized in the low category.

Reflection phase in the first cycle based on the results of teacher discussions with two observer teachers who produce results such as learning conditions between teachers and students still do not meet the implementation of the ARIAS learning model, better time management because when the implementation exceeds the allocation of time that has been determined, many students are confused with the workings of, and student learning outcomes show that the application of the ARIAS learning model is still not effective.

From the results of this first cycle of reflection, then in arranging the planning that can be a solution to be implemented in the second cycle of action, namely teachers should be able to create an atmosphere of the learning process in accordance with the ARIAS learning model, effective in time management, teachers should better guide students who are confused in the use of PhET simulation, and the atmosphere of discussion should be built more interesting.

Cycle II will be held three times a meeting with the location time 2 x 45 minutes. The material that will be discussed in the second cycle is about alternating current (AC) circuit. The implementation of the second cycle will be based on the results of reflection that has been discussed by the teacher with two observer teachers.

Learning planning cycle II, researchers have prepared learning instruments such as learning syllabus, learning implementation plan, worksheets learners (LKPD), written test learning outcomes, observation sheet teacher activity in teaching, and observation sheet student activity in learning. Learning instruments in the second cycle again, the researcher consulted the instrument validator, namely expert lecturers to check the feasibility of the instruments used in learning activities.

The implementation phase of the second cycle of action begins with the provision of pretests to students. Then the teacher provides motivation to students and instill confidence in students in following the learning process. The teacher then conveys indicators, learning objectives, emphasizes the benefits of learning materials, recalls previous materials related to alternating current (AC) circuits. Next, ask a number of questions to find out the knowledge of students related to alternating current circuits. Then students will pass on their knowledge on the questions given by the teacher.

At the core stage of learning, the teacher will divide the students into several groups. This study group division aims to motivate students to take an active role in the teaching and learning process by discussing with each other for problem solving and can collaborate between group members (Hamidah et al., 2022). After completing the group division, the teacher will ask each group to open a virtual PhET simulation experiment about alternating current (AC) circuits.

Closing the learning activity, the teacher will provide a written test to see the mastery of students' science process skills Mertler (2014), on alternating current circuit material in the form of a pos-test. Then the teacher and students will jointly create a resume with the teacher's guidance on important points that arise in learning activities about electromagnetic induction materials. Along with this, the teacher will also provide strengthening of understanding of the material provided.

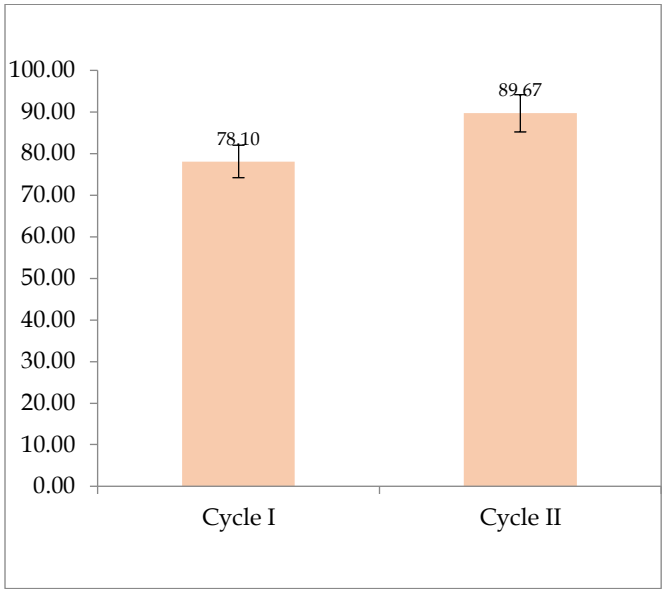

Figure 2. Observation Result of Teacher Activity

Observation phase of Cycle II, the teacher and two observer teachers again observed the teacher's activities in teaching, student activities in learning, student motivation, and student science process skills. Based on the observations, it can be seen that the assessment of both observer teachers on the implementation of the second cycle of action with the average percentage of teacher activity in teaching in the second cycle is 89.67% which is in the category of very good. Based on this value, it can be seen that the activity of teachers has been very good in the second cycle and has increased compared to cycle I. The results of the teacher's activities in cycle I and Cycle II are shown in the graph in Figure 2.

While the percentage of student activity in learning on the implementation of the action Cycle II material alternating current circuit (AC) is 78.10% by being included in the good category. From the results presented can be seen that there is an increase in the

percentage of student activity at each meeting in the second cycle. Based on the results of the second cycle of student activity has also increased significantly compared to the activities of students in cycle I.

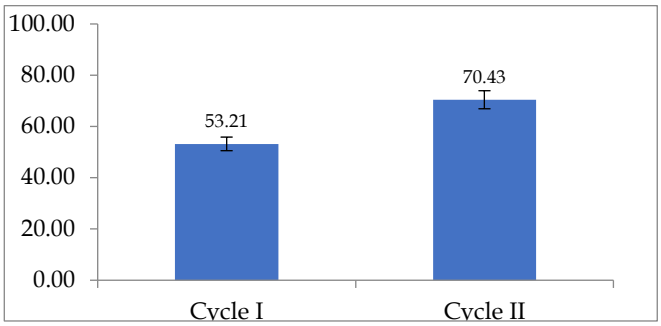

Figure 3. Observation Result of Students Activity

The results of observations of student motivation showed that student motivation in the second cycle was 70.43% which increased compared to student motivation in the first cycle. The level of motivation of students in the second cycle is in a strong Category. This shows that the learning model that is applied successfully increases student motivation is shown by the results of observations of student motivation that always increases in each cycle.

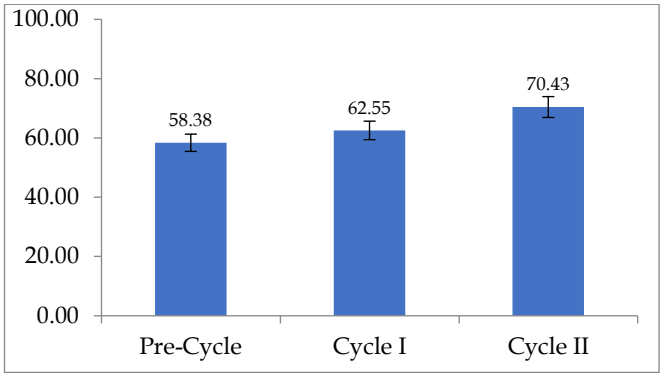

Figure 4. Observation Result of Students Motivation

The results of the calculation of students ' science process skills assessment through the provision of questions on alternating current (AC) circuit material using PhET simulation learning media show that out of a total of 33 students of Class XII MIPA 4, 33 students completed and 0 students declared incomplete. With an average score of 87.44. As for the percentage of students' completeness, it is 100%. This result has increased compared to the previous phase of the percentage of students' completeness in the second cycle is in the category of very good. This shows that the completeness of Class XII MIPA 4 in the second cycle has met the criteria of completeness with an average grade above the standard value and the percentage of class completeness above 80%. From the results of manual calculations obtained N-Gain Score in the second cycle with an average of 0.54 so that the improvement of student learning outcomes can be categorized in the medium category.

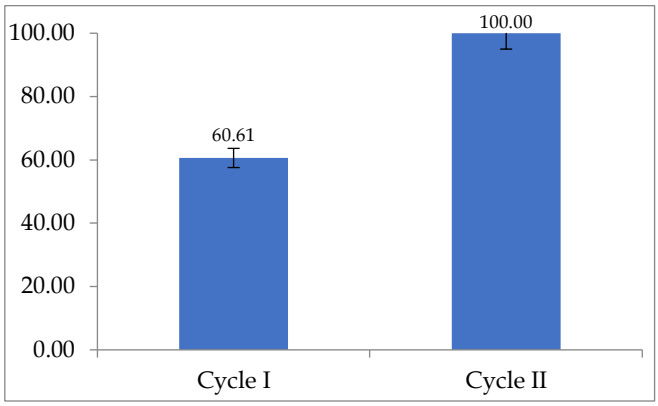

Figure 5. Observation result of Class Completeness

Reflection phase of Cycle II, at this stage will assess what has been done in Cycle II through a discussion by the teacher and two teachers obeserver to determine the success of increasing student motivation and science process skills of students of Class XII MIPA 4 through the application of ARIAS learning model assisted by PhET simulation. The results of reflection in Cycle II include the results of teacher and student activities increased from cycle I, an increase in student motivation from cycle I was 62.55% (strong category) to 70.43% (strong category) in Cycle II, and the results of science process Skills Assessment obtained an average score in cycle I was 73.80 (sufficient category) with the percentage of class completeness was 60.61% (less category) while in the second cycle the average score is 87.44 (good category) with the percentage of class completeness is 100% (very good).

Based on the results of the second cycle, both from the observation of teacher activity in teaching, student activity in learning, student motivation questionnaire, and assessment of science process skills test, it can be concluded that the application of ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation in an effort to increase student motivation (Megalina & Sinambela, 2012) and science process skills in Class XII MIPA 4 SMA Negeri 1 Kampar Timur students has increased significantly. So there is no need to do the next cycle.

Conclusion

The results of observations of teacher activity in an effort to improve student motivation and skills through the application of ARIAS learning model assisted by PhET simulation in cycle I increased in Cycle II with very good category. The results of observation of student

activity in an effort to improve student motivation and skills through the application of ARIAS learning model assisted by PhET simulation in the first cycle with sufficient category increased with good category in cycle II. After the application of the ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation on students of Class XII MIPA 4 SMA Negeri 1 Kampar Timur, student motivation has increased from the pre-cycle phase to cycle I and Cycle II. Science process skills of students of Class XII MIPA 4 SMA Negeri 1 Kampar Timur have increased after the application of the ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation. This is shown by the results of science process skills assessment has increased from cycle I to cycle II. Based on the results of the study, the application of ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model assisted by PhET simulation on students of Class XII MIPA 4 SMA Negeri 1 Kampar Timur can improve students' motivation and science process skills.

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Author Contributions

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Conflicts of Interest

The author declares no conflict of interest.

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