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Implementation of the ARCS Learning Model (Attention, Relevance, Confidence, Satisfaction) in Improving Student Learning Outcomes in Statistics Materials in Class X of SMAS Muhammadiyah Pamekasan

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Abstract

This study employed a Classroom Action Research (CAR) design aimed at enhancing students' learning outcomes in statistics through the implementation of the ARCS learning model in a tenth-grade class at SMAS Muhammadiyah Pamekasan. The research was carried out in two cycles. The first cycle focused on measures of central tendency, while the second cycle addressed measures of data position. The participants of this study were 24 tenth-grade students. Each cycle consisted of four stages: planning, action, observation, and reflection. The findings indicated that the implementation of the ARCS model had a positive effect on students' learning outcomes. Students' learning activities improved from an average score of 2,35 (fair category) in Cycle I to 3,13 (good category) in Cycle II. In addition, students' responses to the learning process increased from an average of 67,5% (positive category) in Cycle I to 73,32% (positive category) in Cycle II. Furthermore, the level of classical learning completeness rose significantly from 20,83% in Cycle I to 70,83% in Cycle II. Based on these results, it can be concluded that the ARCS learning model is effective in improving students' learning outcomes in statistics.

Keywords: ARCS Learning Model, Statistics, Learning Outcomes

1. Introduction

Mathematics learning is a fundamental subject that plays a significant role in developing students' intelligence and precision. This is because mathematics is not merely a set of theoretical concepts taught in schools, but it also has broad applications in everyday life (Maskur, 2020). According to the National Council of Teachers of Mathematics (NCTM), mathematics is inherently embedded in daily human activities. It is widely used for performing calculations, making measurements, and analyzing data, all of which assist individuals in managing information and making accurate decisions. Many real-life problems, whether simple or complex, often require a mathematical approach to produce effective solutions (Rachmantika & Wardono, 2019). Therefore, a solid understanding of mathematics is essential for students to support their development in various aspects of life.

As a foundational discipline, mathematics is not only important within the educational context but also serves as a basis for the advancement of other fields of knowledge. For this reason, mathematics is designated as a compulsory subject at all levels of formal education, from elementary to secondary school. The Ministry of National Education has also established mathematics as one of the graduation requirements, highlighting its importance in preparing students to face future challenges (Rachmantika & Wardono, 2019). Therefore, innovative and relevant teaching strategies are necessary to enhance students' interest and understanding of mathematics.

Mathematics education is an essential component of the learning process, as it contributes significantly to the development of students' logical reasoning, analytical abilities, and critical thinking skills. In the modern era, where information is rapidly evolving, mathematical competence is not only required in academic settings but also plays an important role in daily life and professional environments (Masrukan, 2016). As problems in various fields become increasingly complex, a strong foundation in mathematics is crucial for effective problem-solving and sound decision-making.

However, many students encounter difficulties in learning mathematics due to its abstract nature, while human cognition generally tends to process concrete objects more easily. This challenge becomes more pronounced when instructional approaches are less engaging or lack relevance to students' experiences. Bruner emphasizes that meaningful understanding in mathematics should begin with concrete experiences before progressing to abstract concepts. When students are introduced directly to abstract symbols without sufficient concrete representation, they are more likely to struggle. This situation contributes to low learning outcomes in mathematics, which are commonly used by educators as indicators of students' achievement of educational objectives (Rahmawati & Syukriani, 2011).

Teachers and researchers at Muhammadiyah Pamekasan Senior High School have identified low student achievement as a persistent issue in the learning process, particularly in statistics topics. Based on observations and interviews with tenth-grade teachers, it was revealed that students' conceptual understanding of mathematics remains limited, especially in statistics studied in previous grades. Many students have not yet fully mastered concepts related to both single and grouped data. Furthermore, teachers reported that only a small proportion of students demonstrate a good understanding of the material, while the majority continue to face difficulties during instruction. This condition indicates that most students have not yet achieved adequate mastery of statistical concepts, which directly affects their overall academic performance.

Student learning outcomes are influenced by a variety of factors, which may arise from both internal and external sources. Internal aspects include students' intellectual ability, readiness to learn, and individual talents. Meanwhile, external factors are largely shaped by the surrounding environment, such as the quality of instruction received, which is closely related to teachers' competence and the overall learning conditions (Gunawan et al., 2021). In practice, learning is often delivered in an abstract manner and still relies on a traditional, teacher-centered approach.

Consistent with Piaget's theory of cognitive development, learners need to reach a certain stage of maturity before they are able to grasp abstract concepts, particularly those found in mathematics. Therefore, concrete learning experiences should precede the introduction of abstract ideas. Without this foundation, many mathematical concepts become difficult for students to comprehend, resulting in a less meaningful learning experience (Piaget, 2014). Furthermore, when students are not actively involved in the learning process and instruction is dominated by the teacher, this becomes a critical issue, as it can negatively affect learning outcomes (Johnson, Johnson, & Smith, 2014). In addition, the use of conventional teaching models, the lack of connection between lesson content and real-life contexts, and insufficient emphasis on developing problem-solving skills are common factors contributing to low student achievement.

In response to these challenges, teachers need to select appropriate instructional models that promote student-centered learning, while still maintaining their role as facilitators and guides in the learning process (Suhirman, 2024). One potential approach to address this issue is the implementation of the ARCS learning model (Attention, Relevance, Confidence, Satisfaction). The Directorate General of Higher Education, through the PEKERTI (Improvement of Basic Instructional Skills) program, highlights that the ARCS model can enhance students' learning motivation, which in turn positively influences their academic performance (Ginting, 2010).

According to Noor, the ARCS model is designed to increase students' motivation by capturing their attention, connecting the material to their needs and interests, building their confidence in achieving learning goals, and providing a sense of satisfaction upon task completion (Herti & Anisa, 2016). Through this approach, students are encouraged to actively engage in the learning process through activities such as reading, discussion, and exploration. Moreover, the ARCS model supports students in constructing their own understanding, minimizes misconceptions, and promotes independent learning. Therefore, the application of the ARCS learning model is expected to improve students' learning outcomes (Astleitner, 2004).

In the implementation of the ARCS learning model, students are organized into small, heterogeneous groups consisting of four members, with consideration given to their abilities and interests. In this approach, the researcher functions as a facilitator who supports and encourages students to actively construct their own knowledge. The ARCS model requires engaging and meaningful activities that capture students' attention and connect the learning material to their everyday experiences. As a result, students are not merely passive recipients of information, but are actively involved in developing their understanding of statistical concepts.

Herti and Anisa (Naning, 2007) emphasize the importance of encouraging students to confidently express their ideas, exchange opinions, and communicate mathematical reasoning during group discussions. By providing opportunities for active participation, students become more confident in sharing their thoughts and are better equipped to explore solutions to given problems.

Based on the issues described above, the researcher intends to conduct a classroom action research study by implementing the ARCS learning model in teaching statistics, particularly on measures of central tendency (mean, median, and mode) and measures of data location (quartiles, deciles, and percentiles). This approach is expected to enhance students' learning outcomes by actively involving them in each stage of the learning process, while also creating a more engaging and enjoyable classroom environment. According to Keller, the ARCS model represents a crucial framework for improving students' learning behavior, as it includes strategies to capture attention, relate learning to students' needs, build positive expectations, and provide reinforcement (Kurnia, 2010).

Previous studies support the effectiveness of this model. Research conducted by Sihombing and Imelda (2015), entitled *"Improving Students' Comprehension Ability through the ARCS Motivational Strategy in Class VII of SMP Negeri 22 Medan,"* demonstrated that the application of the ARCS model significantly improved students' understanding of mathematical concepts. The study, which focused on integer addition and subtraction, reported that in the first cycle, students' conceptual understanding reached an average of 67,68% with a learning mastery level of 58,53%. In the second cycle, these results increased to 87,80% for conceptual understanding and 78,04% for learning mastery.

Based on these findings, the researcher is motivated to carry out a classroom action research study entitled: *"The Implementation of the ARCS Learning Model to Improve Students' Learning Outcomes in Statistics for Grade X Students at SMAS Muhammadiyah Pamekasan."* The objective of this study is to examine improvements in students' learning activities, student responses, and learning outcomes in statistics through the application of the ARCS learning model.

2. Methods

This study employed a mixed-methods approach, integrating both qualitative and quantitative data, as the findings consisted of descriptive information as well as numerical results derived from tests. The research design used was Classroom Action Research (CAR), which aimed to enhance students' learning activities, interest, and academic achievement among tenth-grade students at SMAS Muhammadiyah Pamekasan through the application of the ARCS learning model in statistics. The study was conducted from April to May 2025 and implemented in two cycles.

The success of the research was determined based on several criteria: positive student responses reaching at least 70%, individual learning mastery indicated by a minimum score of 72, and classical completeness achieved when at least 70% of students met the required standard. In addition, student activity was categorized as successful if it reached the "good" level (2,50–3,49) or "very good" level (3,50–4,00).

,The procedures of this study followed the CAR framework proposed by Kemmis and McTaggart, which consists of four main stages: planning, action, observation, and reflection. Data were collected using several instruments, including observation sheets to assess student activities, achievement tests to measure learning outcomes, questionnaires to capture students' responses, and field notes for additional documentation. Prior to implementation, all instruments were validated by two experts: a lecturer from the Mathematics Education program and a mathematics teacher at SMAS Muhammadiyah Pamekasan, both of whom were qualified to evaluate the research instruments and provide constructive feedback.

The research subjects were selected based on the results of a preliminary test, which indicated that students had a low level of understanding of statistical concepts and unsatisfactory learning outcomes. Data collection was carried out through multiple techniques, including tests, observations, questionnaires, and documentation. The data were then analyzed quantitatively to determine the level of learning mastery and qualitatively to describe students' activities and responses throughout the learning process.

3. Result and Discussion

Result

Based on the implementation of the study across two cycles, data were obtained from observations of student activities, questionnaire responses, and students' learning outcomes. The observation results indicated an improvement in student activity over time. In the first cycle, the average score of student activity was 2,35, which fell into the "fairly good" category. This result increased in the second cycle to an average of 3,13, categorized as "good." This improvement is illustrated in the following diagram:

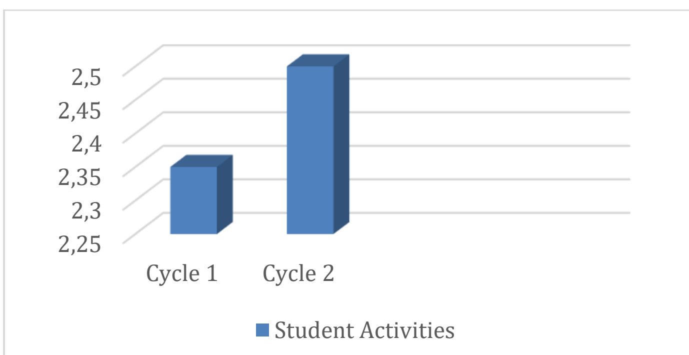

Figure 1. Increased Student Activities

The results of students' responses demonstrated an improvement from the first cycle to the second cycle. In cycle I, the average response rate was 67,50%, which fell into the positive category. This value increased in cycle II to 73,32%, and remained within the positive category. The comparison between the two cycles is illustrated in the following diagram:

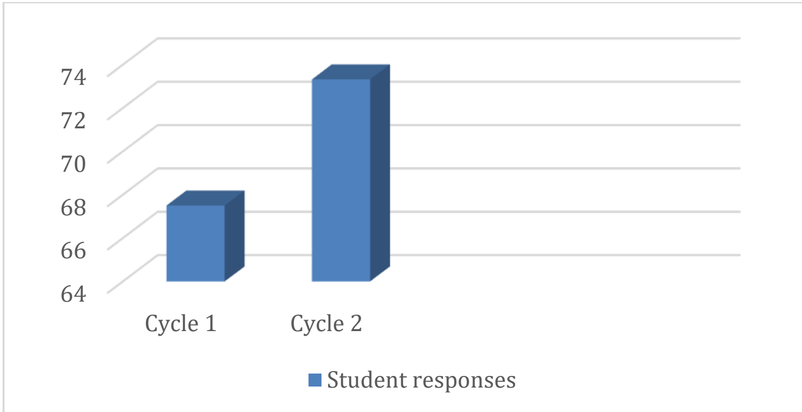

Figure 2. Increased student response

The results of the learning tests indicate a significant improvement in students' performance. In the first cycle, the level of classical completeness was 20,83%, which was below the expected standard. However, in the second cycle, this value increased to 70,83%, indicating that the target had been successfully achieved, as it met the minimum requirement of ≥ 70%. The detailed comparison is presented in the following diagram:

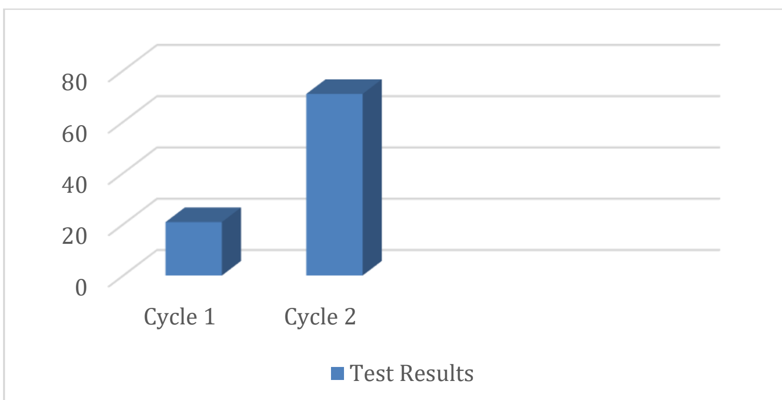

Figure 3. Improvement in student learning outcomes

The findings of this study indicate that all success criteria were achieved, with notable improvements in student activity, responses, and learning outcomes following the implementation of the ARCS learning model in teaching Statistics to tenth-grade students at SMA Muhammadiyah Pamekasan. The average score of student activity increased from 2,35, categorized as "fairly good" in the first cycle, to 3,13, categorized as "good" in the second cycle.
A similar upward trend was observed in students' responses, which improved from 67,50% to 73,32%, both falling within the positive category. Furthermore, classical learning mastery demonstrated a substantial increase, rising from 20,83% in cycle I to 70,83% in cycle II. This result indicates that the minimum standard of 70% for learning completeness was successfully achieved.

Discussion

Based on the implementation of the ARCS learning model in teaching statistics, the findings revealed that during Cycle I, student participation was still relatively low. Many students showed limited attention at the beginning of the lesson, as reflected in their inability to respond correctly to apperception questions. Group discussions were not yet effective, and students tended to lack confidence in expressing their ideas. In addition, the test results indicated that most students had not yet reached the expected level of learning mastery.

However, substantial improvement was observed in Cycle II. Students became more attentive from the beginning of the lesson and were able to answer apperception questions more accurately. Their engagement in group discussions increased, and their self-confidence improved, as seen in their willingness to present their work and share opinions. The final test results also showed that the majority of students had successfully achieved learning mastery at the class level.

Furthermore, the results of Cycle I in this classroom action research suggested that the learning process had not yet been optimal. A considerable number of students were still passive, both in individual and group activities. When asked to represent their groups in front of the class, some students hesitated and even encouraged others to take their place, indicating a lack of confidence. Several students also expressed reluctance when assigned tasks, reflecting low learning motivation. During the test, many admitted that they had forgotten formulas and previously explained material, suggesting that their conceptual understanding was still weak. Some students required additional support and guidance to better comprehend the content. From the teacher’s perspective, although the learning process had been implemented fairly well, time management remained an issue, causing certain stages of instruction to be less efficient.

In Cycle II of the classroom action research, the learning process showed considerable improvement compared to Cycle I. The enthusiasm and participation of tenth-grade students at SMA Muhammadiyah Pamekasan increased significantly. From the initial stage of the lesson, students demonstrated greater attention, as indicated by the ability of most students to respond to apperception questions, although a few inaccuracies were still present. The teacher then delivered brief explanations supported by simple examples connected to students’ daily experiences, effectively addressing the relevance component of the ARCS model.

During group activities, students displayed greater confidence in understanding and discussing the material. Most students actively participated in discussions, shared their ideas, and no longer felt hesitant when presenting group results in front of the class. Both individual and group engagement improved noticeably compared to the previous cycle. This progress was also evident in the final test results in Cycle II on data location measures, where the majority of students were able to comprehend the questions and provide correct answers.

From the teacher’s perspective, the implementation of instruction also became more effective. While Cycle I still encountered issues related to time management and incomplete learning stages, these challenges were successfully addressed in Cycle II. The teacher was able to conduct the lesson in a more structured manner, following the stages of the ARCS model, and fostered a more conducive learning environment that enhanced students' sense of satisfaction. Therefore, it can be concluded that the application of the ARCS learning model effectively improved student activity, responses, and overall learning outcomes.

The improvements observed in students' activity, responses, and learning outcomes through the implementation of the ARCS learning model in statistics are consistent with previous studies. One such study conducted by Sihombing and Imelda (2015), entitled *"Improving Students' Comprehension through the ARCS Motivational Strategy in Grade VII of SMP Negeri 22 Medan,"* demonstrated that the use of the ARCS model significantly enhanced students' understanding of mathematical concepts. The study, which focused on integer addition and subtraction, reported that in Cycle I, the average level of conceptual understanding reached 67,68%, with a learning mastery rate of 58,53%. In Cycle II, these results increased to 87,80% for conceptual understanding and 78,04% for learning mastery.

Similarly, research conducted by Basid (2022) found that the implementation of the ARCS learning model led to a substantial improvement in student outcomes, with learning achievement reaching 92% and student activity increasing to 93%, categorized as very active. This study was conducted in mathematics learning on mixed fraction material for sixth-grade students at SD Negeri 2 Peleyan Kapongan during the 2021/2022 academic year.

Furthermore, a study by Supratman (2021) also reported positive results from applying the ARCS model in mathematics instruction for Grade XI IPA 1 students at SMA Negeri 2 Tanjung Selor. The findings showed that in Cycle I, the average cognitive score was 70,06, with affective outcomes categorized as good and psychomotor outcomes ranging from sufficient to good. In Cycle II, the cognitive average score increased significantly to 92,88, while both affective and psychomotor domains reached good and very good categories, respectively. Observational data also indicated that student activity during learning improved markedly, particularly in their willingness to ask questions and engage with the material compared to Cycle I.

Based on these findings, the present study seeks to implement the ARCS learning model more effectively in order to achieve a significant improvement in students' learning outcomes, particularly in statistics material.

4. Conclusion

Based on the results of the data analysis, it can be concluded that the implementation of the ARCS learning model in teaching statistics—particularly on measures of central tendency and measures of data position—has a positive effect on both the learning process and student achievement. Student activity showed a noticeable increase, rising from an average score of 2,36, categorized as "satisfactory" in Cycle I, to 3,11, categorized as "good" in Cycle II. Students' responses to the learning process also improved, increasing from 67,50% to 73,32%, both of which fall within the positive category.

Moreover, students' learning outcomes demonstrated a significant improvement, as reflected in the increase of classical mastery from 20,83% in Cycle I to 70,83% in Cycle II. This indicates a substantial enhancement in students' understanding of the material following the application of the ARCS learning model.

Based on these findings, several recommendations are proposed for both students and teachers to further optimize the learning process. Students are encouraged to take a more active role in learning activities, both individually and collaboratively, and to develop independent learning habits rather than relying solely on teacher explanations. Additionally, students should build their self-confidence in presenting group discussions and actively participate in responding during presentation sessions, in order to create a more interactive and communicative learning environment.

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