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The Application of ARIAS Learning Assisted by Android-Based Castle Math Application

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Abstract: This research was conducted in Alkarim Junior High School of Bengkulu City which aimed to improve students' creative thinking and learning independence skills in mathematics, specifically in polyhedron material through the application of ARIAS learning model assisted by Castle Math application in smartphone. The method used in this research is classroom action with 2 learning cycles. The result of this research showed that the N-Gain value of students' creative thinking skill is 0.7064, it indicated that there is high improvement on students' creative thinking skill after participating in the learning activity. The data analysis of test result showed students' improvement of creative thinking skill in each cycle. The mean of students' creative thinking test in cycle I is 75.19 with learning success percentage of 62.5%. In cycle II, the test's mean increased to 91.3% with an increase of 16.11 from the mean of cycle I's value. The classical learning success in cycle II reached 93.33%. Students' learning independence also improved in each cycle. In cycle I, the observer's mean score for student learning independence is 77.03 with good criteria. In cycle II, the score increased to 94.76 with very good criteria. Therefore, it can be concluded that ARIAS learning model assisted by smartphone-based Castle Math application succeeded in significantly improving the students' creative thinking skill which can be seen from the N-Gain value, test result, and students' learning independence in each learning cycle.

Keywords: ARIAS, Castle math, Android-based application

Introduction

The ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning model is considered highly important because it encompasses various aspects that significantly contribute to the effectiveness and quality of the learning experience. Here are some reasons why this model is deemed important:

1. Enhancing Student Participation and Engagement

By ensuring safety and creating a supportive learning environment, students are more likely to feel comfortable and participate actively. The aspects of interest and relevance also provide an extra boost for student engagement, as the learning material becomes more meaningful and interesting to them (Hanaris, 2023).

2. Improving Conceptual Understanding

Connecting learning material to students' everyday lives makes these concepts easier to understand. When students see the relevance in learning, they are more likely to grasp these concepts deeply and relate them to real-world situations (Siagian, 2016).

3. Motivating Learning

The aspects of interest and satisfaction help create intrinsic motivation in students. When students feel satisfied with the learning experience and positively challenged, they are more likely to sustain their interest and actively engage in the learning process (Daheri et al., 2023).

4. Providing Student Progress Mapping

Good and relevant assessments help teachers and students understand the extent to which understanding and skills have developed (Rambung et al., 2023). This provides guidance for identifying areas that need improvement and leads to overall learning enhancement.

5. Enhancing Teaching Quality

Teachers can use the ARIAS model as a framework to design and evaluate their teaching strategies (Rambung et al., 2023). By focusing on aspects such as safety, relevance, interest, assessment, and satisfaction, teaching can be more effective and responsive to student needs.

The ARIAS learning model is a development derived from the ARCS model (Attention, Relevance, Confidence, Satisfaction). The ARIAS learning model consists of five components (Assurance, Relevance, Interest, Assessment, and Satisfaction) arranged based on learning theory (Aziz et al., 2014). These five components constitute a unified entity required in learning activities. A brief description of each component and some examples that can be implemented to stimulate and enhance learning activities are as follows.

1. Assurance (Confidence)

It is related to the attitude of belief, confidence in success, or expectations for success. Someone with high self-confidence tends to succeed regardless of their abilities (Perdana, 2019). The attitude where someone feels confident, believing they can achieve something, will influence their behavior to achieve that success.

2. Relevance

It is related to students' lives, whether in terms of current experiences, past experiences, or career needs now or in the future. Students feel that the learning activities they are engaged in have value, are beneficial, and are useful for their lives. Students will be motivated to learn if what they are about to learn is relevant to their lives and has clear objectives (Jamil, 2019).

3. Interest

Learning truly does not occur without interest. Meanwhile, students' interest is greatly influenced by their motivation. Motivated students tend to be more active in the learning process (Oktaviani et al., 2019). Internal motivation, such as curiosity and the desire to achieve success, can be strong drivers for student participation in class and learning activities.

4. Assessment

Assessment is a fundamental part of learning that benefits both teachers and students. For teachers, assessment is a tool to determine whether what has been taught has been understood by students, to monitor students' progress as individuals or as a group, to record what students have achieved, and to assist students in learning.

5. Satisfaction

In learning theory, if students who have successfully completed or achieved something feel proud/satisfied with that success. That success and pride serve as reinforcement for the student to achieve the next success (Ghasya & Suryanti, 2014). Reinforcement that can provide a sense of pride and satisfaction to students is important and necessary in learning activities. Reinforcement is an important factor in learning.

The ARIAS (Assurance, Relevance, Interest, Assessment, Satisfaction) learning and smartphone-assisted learning can complement each other and create a more holistic and engaging learning experience. Smartphone technology can be an effective tool to provide support and accessibility in the context of ARIAS learning. Students can access learning materials, resources, and assessment tools through their smartphones, enhancing security and accessibility.

The use of smartphone technology in learning needs to be carefully considered, and there should be supervision to ensure that technology is used productively and does not disrupt the learning focus. Integration between the ARIAS learning model and smartphone technology can create a balanced learning environment, support student needs, and harness the positive potential of digital technology. Smartphone technology enables the presentation of learning materials interactively and visually (Septiasari & Sumaryanti, 2022). By combining it with the ARIAS model, teachers can present materials in an engaging and motivating way, stimulating students' interest and creative thinking abilities.

The ability to think creatively in mathematics learning has several significant benefits. Creative thinking in mathematics allows students to see various approaches and solutions to mathematical problems (Yazar Soyadı, 2015). This opens the door to more creative thinking and alternative solutions that may not be considered with conventional approaches. Creative thinking allows students to develop abstract thinking skills, which are important in understanding complex mathematical (Melia et al., 2021). Students can more easily visualize and understand mathematical abstractions by harnessing their creativity.

There are many creative applications that can be used to develop students' creative thinking abilities. Integrating smartphone technology allows students to actively participate in creativity-focused learning activities, thus fostering students' learning independence throughout the learning (Shubina & Kulakli, 2019). Student learning independence is a critical aspect of the education process. Students' ability to learn independently has several significant benefits.

Learning independence equips students with skills that will help them continue learning throughout their lives, as the rapid changes in today's world require adaptability and the ability to continuously update knowledge. Self-directed learners tend to have better resilience to challenges. They are able to overcome learning barriers, identify solutions, and remain enthusiastic even in the face of difficulties (Farisuci et al., 2019).

Based on observations conducted by researchers at SMP Alkarim Bengkulu, it was found that students' creative thinking abilities and learning independence in mathematics learning are still low. The average score for students' learning independence is 63.9, and the score for students' creative thinking abilities in flat-faced solid geometry material is still below 6.0. The low level of students' creative thinking abilities and learning independence in the classroom may be caused by various factors.

Some factors influencing the low level of creative thinking abilities and learning independence include the use of inappropriate learning models during the learning process, which have not been able to develop students' creative thinking abilities and learning independence. In addition, the lack of activities that stimulate imagination hinders the development of creative thinking abilities. The lack of imagination-stimulating activities has been identified as a problem in the development of students' creative thinking abilities. The use of appropriate learning models assisted by smartphone-based technology can help overcome these obstacles. Based on interviews between researchers and students at SMP Alkarim Bengkulu, it was found that students want easy access to educational resources, such as learning applications, and the information they need anytime, anywhere, without being constrained by limitations of place or time.

Based on research conducted by Ghasya & Suryanti (2014) on the influence of the ARIAS learning model (Assurance, Relevance, Interest, Assessment, Satisfaction) in enhancing students' mastery of concepts and creative thinking abilities, it was found that the pretest and posttest results of creative thinking abilities before and after receiving the ARIAS learning model showed improvement. Similar findings were also reported by Agus & Sholahudin (2023) in their study on the effect of Android-based learning media on improving students' mathematical creative thinking abilities, where it was found that Android-based learning media indeed enhanced students' mathematical creative thinking abilities.

Based on the aforementioned issues, the researcher conducted a study utilizing Android with a learning model suitable for students' needs. The use of the ARIAS learning model with the assistance of the Castle Math application based on Android is expected to enhance students' creative thinking abilities and learning independence.

This research is very important because it can provide insights into the extent to which the implementation of the ARIAS learning model and the Castle Math application can improve learning effectiveness. By understanding its impact, teachers and educators can optimize teaching methods to support better learning outcomes. This research can provide innovative learning alternatives that can be adopted by educators. If proven

successful, the ARIAS learning model aided by the Castle Math application could serve as inspiration for teachers to create more engaging and effective teaching approaches.

Method

The type of research conducted is Classroom Action Research (CAR). Classroom Action Research (CAR) is a research approach carried out by teachers or educational practitioners in their own classrooms to understand, improve, and address problems that arise in the learning context. CAR aims to create changes and improvements in teaching practices and provide a better understanding of the learning process. There are four main activities in Classroom Action Research:

1. Planning

The planning stage involves identifying problems or challenges in classroom learning. Researchers design steps to address the problems of students' creative thinking abilities and learning independence and set specific goals for improvement. This plan includes data collection methods, teaching strategies, and evaluation of outcomes.

2. Action

After planning, researchers implement it in the daily teaching process. Data is collected during this stage to monitor progress and evaluate the impact of the actions taken. Researchers use various data collection techniques, such as observation, interviews, or tests.

3. Observation

At this stage, researchers systematically monitor and observe the implementation of the action plan in the classroom. This observation involves direct observation of learning activities, student responses, and the effectiveness of adopted strategies. These observational data serve as the basis for identifying successes or obstacles in the improvements made.

4. Reflection

After completing the implementation stage, researchers evaluate the results of the actions taken. This involves reflecting on the collected data and analyzing the achievement of set goals. Researchers also determine whether the changes or innovations implemented have positively impacted learning and achieved the desired goals.

This process is cyclical because after the evaluation stage, researchers return to the planning stage to make further improvements or address new emerging problems. Thus, this Classroom Action Research is an ongoing effort that researchers undertake to improve the quality of learning in the classroom through reflection, corrective action, and continuous evaluation.

This research was conducted on eighth-grade students at SMP Alkarim in Bengkulu city, comprising 7 male students (46.666%) and 8 female students (53.333%). The learning material in this research was flat-faced solid geometry (Cube, Rectangular Prism, Prism, and Pyramid). All students participated voluntarily in this research. After the students completed the cycle test questions, the researcher checked the students' work and assessed their creative thinking abilities based on the answers they provided. Students' learning independence was observed by an observer during the learning process.

Mathematics learning activities using the Castle Math application through the ARIAS learning model at SMP Alkarim in Bengkulu city in this research are said to improve students' creative thinking abilities and learning independence if they meet several criteria: 1) $80<NR\leq100$, where NR is the average score of students' creative thinking abilities, 2) classical learning completeness score $\geq85\%$, 3) N Gain test score > 0.3, and 4) the average score of students' learning independence must be more than 80.

Results and Discussion

The smartphone application used in this research is Castle Math, developed by UHAMKA alumni. The Castle Math application is inspired by castle structures, which are composed of stacks of solid geometry shapes. The Castle Math application functions as a learning media for flat-faced solid geometry for junior high school/madrasah tsanawiyah students. The Castle Math application contains learning materials on cubes, rectangular prisms, prisms, and pyramids. The advantage of this application lies in its presentation of the properties of flat-faced solid geometry in an engaging manner with animated .gif format, making it easy for students to remember and understand. This application was developed by Barqilatief Mujasir, an alumni of UHAMKA.

The Castle Math application has a visually appealing interface, which attracts students when studying flat-faced solid geometry materials. When we open the Castle Math application, we need to click "start" to enter the material menu. Then, after entering the material menu, we will select the material according to our preference. The appearance of the Castle Math application is as follows:

Figure 1. Initial display of the Castle Math

Figure 2. Classroom Learning Using the Castle Math Application

Figure 3. Students Using the Castle Math Application in Class

The test of creative thinking ability was conducted by providing cycle I and cycle II test questions to the students to assess the extent of improvement in students' mathematical creative thinking abilities after using the ARIAS learning model assisted by the Castle Math application. After the test was conducted, the students' answers were corrected and scored based on the scoring guidelines for creative thinking abilities adapted from Surya et al., (2017), namely Fluency, Flexibility, Originality, and Elaboration. In this research, the researcher elaborated on the parts assessed for each indicator of students' creative thinking abilities.

Firstly, regarding Fluency, which refers to students' ability to generate a number of ideas or solutions quickly and without obstacles. In the context of flat-faced solid geometry learning, fluency means students' ability to smoothly and effortlessly generate various ideas or concepts related to the topic. For example, students may easily develop variations of flat-faced solid geometry shapes. Secondly, Flexibility reflects students' ability to think diversely and adapt their approach depending on situational demands. In the context of flat-faced solid geometry, flexibility means students can generate ideas or solutions from various perspectives or creative approaches. They can adapt their knowledge to solve problems or create new concepts differently.

Thirdly, Originality refers to students' ability to generate new, innovative, and unusual ideas or solutions. In flat-faced solid geometry learning, originality means students can develop concepts or solutions that not only follow common patterns or conventions but also provide elements of novelty and uniqueness. Fourthly, Elaboration involves developing ideas or solutions by providing more detailed, explanatory, or in-depth descriptions. In the context of flat-faced solid geometry, students who can elaborate will be able to explain and expand their concepts in more detail. They can articulate the relationships between elements, provide justifications, and

present their thoughts deeply. The analysis of the improvement in students' creative thinking can be calculated using the N-gain formula with the following criteria:

Table 1. Criteria For N-Gain Level (G)

Limitations	Category
$g > 0,7$	High
$0,3 \leq g \geq 0,7$	Moderate
$g < 0,3$	Low

Table 2**.** N-Gain value of students' creative thinking

	N	Minimum	Maximum	Mean	Std. Deviation
N_Gain	15	.08	1.00	.7064	.30159
Valid N (listwise)	15				

From the table 2 above, the N-Gain value obtained is 0.7064, indicating a high improvement in students' creative thinking after following the ARIAS learning model assisted by the Castle Math application. The higher the N-Gain value, the greater the improvement. Thus, the learning approach used has succeeded in substantially enhancing students' creative thinking abilities. This suggests that the teaching strategy or method is effective and can be considered for future use. The results of the students' creative thinking ability test using Castle Math show that there has been an improvement from cycle I to cycle II. The results are shown in the following Table 2.

Table 3. The results of the students' creative thinking ability test ın cycle ı and ıı.

No	Score	Cycle I	Cycle II
1	Highest score	95	100
2	Lowest score	65	68
3	Average Score	75,19	91,3
4	Classical learning completeness	62,5%	93,33%

The test results were analyzed, and the analysis showed the development of students' creative thinking abilities in each cycle. Based on Table 3, it can be seen that classically, students' learning success has improved. It is evident that the average score of students' creative thinking ability test in Cycle I, obtained by 15 students, was 75.19 with a learning success rate of 62.5%. In the Cycle II test, the average score of 15 students increased to 91.3, an increase of 16.11 from the average score of Cycle I, with a classical learning completeness rate of 93.33%.

In the Cycle II learning, students were already accustomed to learning activities using the ARIAS model assisted by Castle Math. From Table 1, it can be seen that in this final test of Cycle II, the average student score is 91.3, with a score range from 68 to 100. This indicates that in Cycle II, there has been an increase in the average score of the final cycle test by 16.11 points from the average score of Cycle I. The average score of students in Cycle II has reached the success indicator of the action. Therefore, the action implementation was not continued in the next cycle.

Observation of students' learning independence was carried out by observers tasked with observing 5 groups. Learning independence indicators based on Hidayati & Listyani (2010) include six aspects: (1) independence from others, (2) self-confidence, (3) disciplined behavior, (4) sense of responsibility, (5) initiative-based behavior, and (6) self-control.

In this study, students' learning independence is based on the following nine indicators: (1) having the initiative to learn mathematics, (2) analyzing mathematics learning needs, (3) setting learning targets and objectives, (4) monitoring, organizing, and controlling mathematics learning, (5) viewing difficulties as challenges, (6) utilizing and seeking relevant learning sources, (7) selecting and determining mathematics learning strategies, (8) evaluating the process and results of mathematics learning, and (9) self-confidence (self-efficacy). The overall observation results of students' creative thinking abilities can be seen in Table 4 below:

Based on Table 4, it can be seen that students' self-directed learning in the learning process with the ARIAS model aided by the smartphone-based Castle Math application improves with each cycle. Table 3 indicates that in Cycle I, the average observer score for students' self-directed learning was 77.03, rated as good, while in Cycle II, the average observer score for students' creative thinking ability was 94.76, rated as very good. This is

because in Cycle I, students were not yet accustomed to using the smartphone-based Castle Math application in the learning process. Therefore, teachers reflected on their actions to improve students' creative thinking abilities in Cycle I.

Table 4. Scores of observation results of students' creative thinking abilities in cycles ı and ıı

	Cycle I	Cycle II
Meeting I	34	42
Meeting II	41	47
Average Score	77,03	94,76
Category	Good	Very Good

Conclusion

The conclusion of this study is that ARIAS learning provides a foundation for teaching that motivates and engages. Activities involving students actively, providing realistic challenges, encouraging innovation, allowing room for artistic expression, and using symbols can trigger students' desire to learn and think creatively. The use of the Android-based Castle Math application provides interactive and enjoyable dimensions to learning. Students can learn through more visual and dynamic methods, thereby increasing their engagement and interest in the learning material. The success of this research is based on a good understanding of students' needs and characteristics. ARIAS learning is tailored to individual needs, allowing for more appropriate responses to differences in learning styles and students' levels of understanding.

Recommendations

Recommendations for this study include recommending the implementation of a monitoring and evaluation system to measure students' progress over time. This can help identify areas that need improvement and enhance the effectiveness of learning. Collaboration with external parties, such as students' parents or the community, should be encouraged to support learning outside the school environment. Involving parents in supporting creative learning and self-directed learning can create positive synergy.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM Journal belongs to the authors.

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