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An Analysis of Grade IX Students' Learning Motivation Through the ARCS Model Supported by PhET Simulations

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ABSTRACT

This study aims to analyse the learning motivation of Grade IX students at SMP Negeri 13 Surabaya using the ARCS model (Attention, Relevance, Confidence, Satisfaction) assisted by PhET simulation media. A quantitative descriptive method was used with a questionnaire consisting of 20 items, each representing one ARCS component. Data were analysed using a percentage formula (NP = R/SM × 100%) to determine the motivation level category. The results showed that all ARCS components were in the high to very high categories, with *Satisfaction* scoring the highest at 87.75%. These findings suggest that PhET simulations positively influence students' learning motivation. The study highlights the potential of interactive, technology-based media to enhance student engagement and learning satisfaction. It is recommended that educators integrate such tools into teaching to support students' motivation and improve learning outcomes.

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1. Introduction

Education is important in shaping a competent and competitive young generation (Susianita & Riani, 2024). According to law No. 20 of 2003, education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, nation and state (Ichsan, 2021). In this era of advanced technology, education faces new challenges in presenting interesting and effective learning materials to motivate students to learn. One way to motivate students to actively study is to use the application of a guided inquiry learning model by

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utilizing virtual laboratories in science learning at the junior high school level (Wulandari et al., 2022).

The inquiry learning model is a learning that requires students to be able to plan and conduct experiments, collect and analyse data and draw conclusions that are oriented towards solving problems (Prasetiyo & Rosy, 2020). So that with the inquiry process, students are actively involved in solving a problem given by the teacher (Sugianto, 2020). In modern times like today, technology has developed very rapidly so that education has also undergone changes. The most visible part is the use of technology in the learning process. The process of using technology in education creates new opportunities to improve the quality of learning in all subjects, including in the field of natural sciences (Kartika, 2022). The guided inquiry learning model is one of the models in inquiry-based learning used in science learning (Ida Ayu Putu Nova Warmadewi, 2022). The guided inquiry learning model is emphasized to students to be able to carry out the process of knowledge search compared to knowledge transfer. This is because students are learning subjects who must actively involve themselves in the learning process, while teachers are only mediators and facilitators who coordinate and guide student learning activities (Budiyono & Hartini, 2016). Science learning materials, 2 such as the laws of physics and mathematical principles are often considered difficult by junior high school students. One of the physical materials is Archimedes' law.

Archimedes' law is a basic law in physics that discusses the buoyancy force and inertia of objects in fluid (Kertinus, 2019). In order for students to understand the material, experiments are needed. Experiments carried out in this study using a virtual laboratory. There are many types of virtual media that support the science learning process that are available and can be downloaded for free, one of which is virtual media to support the learning process on Archimedes' law material. Because the direction and magnitude of Archimedes' force cannot be seen directly. so virtual media is needed that can visualize Archimedes' force. Through this visualization, students are expected to observe the direction and magnitude of Archimedes' force (Sari, 2013).

Currently, there are many practicum media available with Virtual Laboratory, one of which is PhET Colorado. PhET Colorado is a site that provides free science practicum learning that can be used for classroom or individual learning (Budi, 2022). The advantage of this site is that it can be used as a learning approach that requires the involvement of students who have creative thinking. students who have creative thinking where students must be able to combine the with the virtual findings from the experiments, the ongoing learning will be more experiments, the ongoing learning will be more interesting because students can can learn as well as play on experiments through the PhET (Rizaldi, 2020). In addition, using PhET can visualize science concepts in the form of image models. Science concepts in the form of image models. Like when doing an experiment on the law of Archimedes can see how objects float, drift, sink.

At this time, learning media through virtual laboratories has not been used optimally because of the lack of LKS as a support for virtual laboratory media in the science learning process. So that students are expected to improve their knowledge of scientific methods and scientific attitudes. The scientific method in question is the activity of observing, classifying, measuring, formulating problems, formulating

hypotheses, identifying variables, designing experiments, and concluding. Meanwhile, scientific attitudes include honesty and meticulousness when taking data, being responsible in carrying out experiments, 3 respecting the opinions of others, daring to express opinions and discipline (Sari, 2013).

Therefore, this study aims to improve students' understanding of Archimedes' law by applying a guided inquiry learning model using Virtual Laboratory. This learning model allows students to actively engage in virtual experiments that visualize Archimedes' concept interactively. In addition, using Virtual Laboratory experiments aims to increase the learning motivation of junior high school students because learning motivation is a key factor in effective learning.

2. Method

This study uses a quantitative approach to describe students' perceptions of the learning process that has been implemented. The quantitative approach was chosen because it can explore in depth the experiences, motivations, and subjective views of students (Wijaya, 2019). The instrument used in this study is a student response questionnaire based on the ARCS (Attention, Relevance, Confidence, Satisfaction) model developed by Keller. The ARCS model was chosen because it is effective in systematically measuring aspects of student learning motivation (Keller, 2010). The questionnaire consists of several closed-ended statements on a 1 – 4 point Likert scale, which includes four main components: attention, relevance, confidence, and satisfaction.

Table 1. Student motivation questionnaire assessment score

Alternative answer	Score
Strongly agree	4
Agree	3
Disagree	2
Strongly disagree	1

Data collection was carried out by distributing questionnaires directly to students after they participated in learning activities. The collected data were analyzed using quantitative descriptive statistical techniques, specifically percentage analysis, to determine the overall and component-wise levels of student motivation. The following formula was used to calculate the percentage score for each aspect (Purwanto, 2010).

$$NP = \frac{R}{SM} X\ 100\% \quad (1)$$

Information:
NP = Percent value searched
R = Raw scores obtained by learners
SM = The ideal maximum score of the test in question
100 = Fixed number

Based on the results of the questionnaire data analysis, each student's learning motivation score is converted into a percentage. This percentage is then

interpreted using a predefined benchmark scale to determine the level of student motivation. The criteria for interpreting the percentage scores are outlined as follows.

Table 2. Criteria for success in learning motivation

NP range (%)	Category
86 – 100	Very High
71 – 85	High
56 – 70	Moderate/Fair
41 – 55	Low
≤ 40	Very Low

(Purwanto, 2010)

The subjects involved in this study were 32 students in grades IX-J. The reason the researcher chose class IX-J is because the class is less motivated to learn because at the time the researcher teaches, many people enjoy chatting with their friends and some sleeping, so by learning science process skills, it is hoped that students will be motivated to be more enthusiastic about learning.

3. Results and Discussion

Results

To provide a clearer understanding of students' learning motivation levels, the questionnaire data were systematically organized and presented in tabular form. This table illustrates the percentage scores corresponding to each dimension of the ARCS model—Attention, Relevance, Confidence, and Satisfaction. The tabular presentation facilitates a quantitative analysis of student responses, serving as a foundational basis for drawing conclusions regarding the effectiveness of the implemented instructional strategies. Through this table, it is possible to identify the extent to which students responded positively to learning activities utilizing interactive simulation media, as well as to highlight the motivational components that are most influential during the learning process. The following table presents the results of the students' responses.

Table 3. Learning motivation results of each indicator

Aspects (ARCS)	NP (%)	Category
Attention	83.83%	High
Relevance	83.33%	High
Confidence	84.00%	High
Satisfaction	87.75%	Very High

Based on the analysis of student learning motivation questionnaires utilizing the ARCS (Attention, Relevance, Confidence, Satisfaction) model, the overall findings indicate that the students' motivation levels fall within the high to very high category. Specifically, the Attention component received a percentage score of 83.83%, suggesting that students demonstrated considerable interest and attentiveness toward the instructional material and the learning process. This outcome implies that the pedagogical strategies employed by the instructor effectively stimulated students' curiosity and engagement with the lesson content.

Furthermore, the Relevance dimension yielded a score of 83.33%, also

categorized as high. This result indicates that the instructional material presented by the teacher is perceived by students as relevant and meaningful, aligning with their needs, personal interests, and real-life contexts. Additionally, the Confidence aspect achieved a score of 84.00%, reflecting that students possess a strong belief in their ability to effectively engage with and complete learning tasks, as well as confidence in their potential to succeed.

The most prominent indicator is the Satisfaction component, which attained the highest score of 87.75%, placing it in the very high category. This result signifies that students experience a high level of satisfaction with both the learning process and its outcomes. Such satisfaction may stem from a positive learning environment, recognition and appreciation from the instructor, or the achievements students have accomplished during the learning activities. Overall, the four dimensions of the ARCS model collectively indicate that students' learning motivation is relatively high. This outcome reflects the effectiveness of the teacher's instructional design in capturing students' attention, ensuring material relevance, fostering confidence, and delivering satisfactory learning experiences. Based on students' responses regarding their learning motivation, the following diagram illustrates the distribution of results across the ARCS model components.

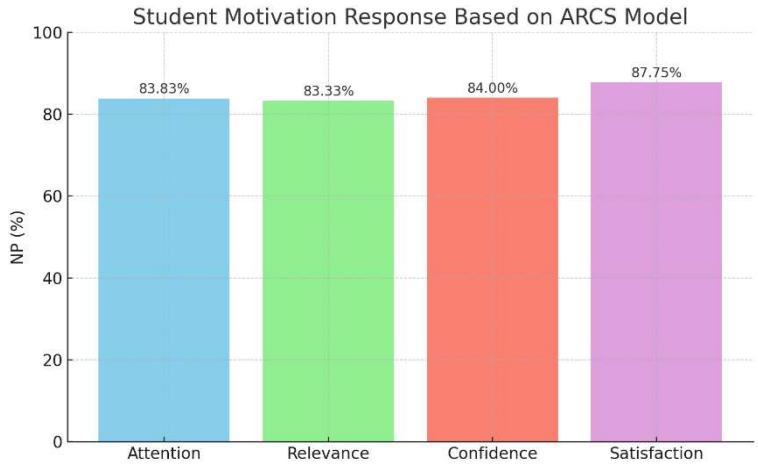

Figure 1. Students' Learning Motivation Response Results.

Discussion

The findings of the study conducted at SMP Negeri 13 Surabaya, specifically in class IX J, reveal that students' learning motivation falls within the high to very high category across all four dimensions of the ARCS model—Attention, Relevance, Confidence, and Satisfaction. These results suggest that the instructional strategies implemented, particularly through the integration of PhET Simulation, have effectively addressed the psychological needs of students by fostering interest, perceived relevance, confidence, and a sense of satisfaction throughout the learning process. The integration of interactive media such as PhET Simulations significantly contributes to these outcomes. This animation-based simulation, which promotes self-directed exploration, facilitates students' understanding of abstract concepts in science particularly physics in a more tangible and engaging manner. These findings are consistent with the study conducted, which demonstrated that the use of interactive digital simulations can enhance students' interest and motivation in learning, especially in grasping conceptual and visual content (Wati, 2020).

These findings are consistent with prior research indicating that innovative and interactive instructional approaches play a crucial role in enhancing student motivation and learning outcomes. For instance, the originator of the ARCS model demonstrated that instructional strategies grounded in the four ARCS components are effective in increasing student engagement (Keller, 2010). Similarly, a study conducted reinforces these results, showing that learning activities focused on fulfilling students' needs for attention and relevance positively influence their intrinsic motivation and self-confidence (Astuti, 2021). The implications of these findings highlight the importance of educators continuously developing engaging and relevant instructional strategies that empower students to feel confident and satisfied throughout the learning process. The ARCS model has proven to be an effective framework not only for delivering content, but also for fostering students' internal motivation.

The findings of this study demonstrate that the application of the ARCS model, supported by interactive learning media such as PhET Simulations, is highly effective in enhancing students' learning motivation. This strategy holds significant potential for replication and implementation in other educational settings with similar student characteristics, both at the junior high school level and across different educational levels. To ensure successful adoption, it is essential to provide professional development for educators focused on the integration of interactive learning technologies and the design of instruction that targets students' internal motivational needs. Furthermore, the ARCS-based instructional approach can be adapted and extended to a wide range of subjects beyond physics or science. For instance, in mathematics or language learning, interactive visual tools and simulations can be employed to convey abstract concepts while simultaneously addressing the four motivational components: attention, relevance, confidence, and satisfaction. With appropriate contextual adjustments to content and methodology, this strategy is expected to contribute positively to improving learning outcomes and fostering students' intrinsic motivation in a broader and more sustainable manner.

4. Conclusions

Based on the results of the analysis of the questionnaire data of students in grade IX j of SMP Negeri 13 Surabaya to learning motivation using the ARCS model, it can be concluded that in general, the level of student learning motivation is in the high to very high category. The four aspects in the ARCS model—Attention, Relevance, Confidence, and Satisfaction—showed a percentage score above 80%, which reflects that the learning applied has been able to meet the motivational needs of students in the learning process.

The Satisfaction aspect obtained the highest score in the very high category, indicating that students are satisfied with their learning experience. While other aspects also showed positive results, showing that students felt interested, understood the relevance of the material, and were confident in following the learning. This indicates that the implementation of a planned learning strategy that involves the principles of ARCS can have a positive impact on students' motivation to learn. These findings reinforce the importance of the role of teachers in designing learning that not only focuses on the material but also pays attention to the

psychological and motivational factors of students so that the learning process becomes more effective and meaningful.

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