Attention, relevance, confidence, satisfaction (ARCS) model on students’ motivation and learning outcomes in learning physics

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Abstract. The learning outcomes are influenced by several factors, both from the teachers and the student and still many students who are not motivated to learn, so their learning outcomes tend to be lower. One of the learning models that can be used to improve motivation and learning outcomes is by using the ARCS learning model. This research aims to determine the influence of ARCS models on the motivation and learning outcomes of students in optical equipment at Public Senior High School 4 Banda Aceh. The method of research was quantitative method with pretest-posttest control group design. The population in this study was all students of grade eleven. The sample was selected randomly, grade eleven 4 as an experiment class and grade eleven 5 as control class, each consisting of 32 students. Research instruments were written test and motivation questionnaire and the data analyzed used T-test and N-gain. The result of the four indicators consists of attention obtained 4.55, relevance obtained 4.50, confidence obtained 4.60 and satisfaction obtained 4.74, which means there is a significant influence to the learning outcomes and motivation of students through the ARCS model for optical equipment.

1. Introduction

The result of learning based on the average percentage of optical instruments in the national exam in Public High School 4 Banda Aceh in 2016/2017 is still relatively low about 40.71. Based on early observation, many students are less interested in learning physics, because of the assumption that physics is complicated and have abstract objects. In the teaching and learning process, teachers used discussion methods. The learning process begins with providing information, then continuing by doing questions and answers session, forming a learning group, and giving assignments. Finally, the students work on assignments given by the teacher. In the learning process, teachers use learning facilities such as textbooks and whiteboards. In classroom learning, students’ study in groups assigned by teachers. The study group did not work effectively as most of the students were not discussing each other and were ashamed to ask questions. When student appeared in front of class to solve a problem, the other students don’t interact with each other. This prevents the students from learning seriously and making his learning outcomes below average.

The results of learning are behavioral changes, in a broader sense that includes areas of cognitive, affective and psychomotor. The learning outcomes are also interpreted as the level of mastery achieved
by students in following the learning process according to the educational objectives established [1]. 
The learning outcomes are influenced by several factors, both from the teacher and the students. Motivation and interest are a factor come from student while the factors of the teacher are the selection of learning strategies, whether methods, media, or models of learning should consider the interest of the students [2]. In the learning of physics, teachers consider the interest and motivation aspects in the selection of learning models. In this study, the learning materials that are taken are optical tools that are much directly related to daily life. However, many students have difficulty in applying optical tools with various problems in life. It is necessary for a learning model that can increase the motivation of students, one of the motivational models of ARCS.

Keller and Kopp develop the ARCS model in 1987, which can influence the motivation of achievement and learning outcomes [3]. This learning model is developed based on the expectancy-value theory which contains two components, the value of the goal to be achieved and expectancy to successfully achieve that goal. From the two components, Keller was developed into four components of attention, relevance, confidence, and satisfaction with the acronym ARCS [4]. Based on Keller’s theory, the motivation of ARCS is a model to increase motivation for learning materials. In this case, the ARCS model has a strategy that can be used to increase motivation and student activity in learning. In ARCS models there are the following tips: (1) to increase students’ attention to the subject matter; (2) Linking material with its benefits in daily life; (3) To increase student confidence in teacher-provided material; and (4) to realize the satisfaction of the students in the learning process and the materials he learns [5].

Based on the motivation model of ARCS, teachers must pay attention and explain the learning objectives. The material being taught should be relevant to everyday life so that the students can easily understand. During the learning process, teachers must also foster the student's confidence in their abilities. At the end of learning, teachers must also reward students so students will always be encouraged to learn.

The ARCS Model is very effective to use because it is tailored to students’ needs or interests and is developed based on theories and real experiences to awaken the spirit of learning the students optimally encourage other students to obtain satisfactory learning outcomes [6]. Based on the formulation of the problem, the study aims to determine the influence of ARCS models on the motivation and outcome of students' learning of optical equipment at Public Senior High School 4 Banda Aceh.

2. Method
The research used the quantitative method with a pretest-posttest control group design. The population in this research was all students of grade eleven Public Senior High School 4 Banda Aceh. The sample were chosen by random technique, the grade eleven 4 class were chosen as experiment class and grade eleven 5 as control class, each consisting about 32 students. The object of this research is the result of learning and motivation in the students of the sample. The instruments used in this study are multiple-choice forms consisting of optical equipment and motivation questionnaire. Before using the instruments, the test and questionnaires are validated by the relevant lecturers, then tested to the students with a reliability score of 0.79. The data analysis techniques in this study used T-Test and N-Gain test.

3. Results and discussion
3.1. Student learning outcome
This study was conducted on two classes consisting of grade eleven 4 as an experiment and grade eleven 5 as control. Before obtaining the data, researchers conducted research on the field by selecting the ARCS model as a learning model to be applied to the experimental class. The purpose of this study is to know the average difference between the experiment class and control class. The data analysis results are described in table 1.
Table 1. Analysis of normality test.

| Classes     | Score of pretest | Score of posttest | Information          |
|-------------|------------------|-------------------|----------------------|
|             | $X^2_{count}$    | $X^2_{table}$     | $X^2_{count}$        | $X^2_{table}$       |
| Experiment  | 20.45            | 43.80             | 4.60                 | 43.80               | Normally distributed |
| Control     | 20.99            | 43.80             | 34.99                | 43.80               | Normally distributed |

The data in Table 1 is used to carry out the tests in the form of pretest and posttest data. This normality test is also used to determine the statistics to be used, whether using parametric or non-parametric statistics [7]. This study uses parametric statistics, parametric statistics are mostly used to analyze data in the form of intervals and ratios based on certain conditions, for example data variables that will be analyzed for residual values must be normally distributed [8]. The data from the pretest between the experimental and control classes obtained $20.45 < 43.8$ and $20.99 < 43.8$, it can be concluded that the data scattered in both classes are normally distributed. Furthermore, the results of the posttest analysis between the experimental class and the control class obtained $4.60 < 43.8$ and $34.99 < 43.8$ so that according to the testing criteria $H_0$ was accepted. It can be concluded that at the pretest and posttest the experimental and control classes were normally distributed.

Table 2. Analysis of the homogeneity test.

| Variant | $F_{count}$ | $F_{table}$ | Information          |
|---------|-------------|-------------|----------------------|
| Pretest | 1.23        | 1.82        | Homogeneous          |
| Posttest| 1.79        | 1.82        | Homogeneous          |

Table 2 shows the results of the homogeneity test data analysis in both variants, namely pretest obtained $F_{count} < F_{table}$ or $1.23 < 1.82$ and posttest obtained $1.79 < 1.82$. The results of data analysis in both variances can be concluded that the pretest and posttest of the experimental class and the control class in the two variants are homogeneous.

Table 3. Analysis of t-test.

| Groups     | Average | $T_{count}$ | $t_{table}$ | Interpretation | Conclusion          |
|------------|---------|-------------|-------------|----------------|---------------------|
| Experiment | 80.10   | 5.67        | 1.67        | $T_{count} > t_{table}$ | $H_i$ was accepted (significant difference) |
| Control    | 66.50   | 1.67        |             |                 |                     |

Table 3 shows that the results of the t-test analysis on the posttest variant obtained $t$ count of 5.67 and $t$ table of 1.67, so it can be concluded that $t_{count} > t_{table}$ is $5.67 > 1.67$. The results of the analysis can be concluded that in the experimental class and control posttest there were significant differences. This is evident from the results of the study showing that there is an influence of the ARCS model on students learning outcomes compared to conventional learning lectures and discussions.

Table 4. Average N-gain analysis of student learning outcome.

| Classes     | N-gain | Criteria   |
|-------------|--------|------------|
| Experiment  | 0.60   | Medium     |
| Control     | 0.36   | Medium     |

Table 4 shows that the average N-gain in both classes is in the moderate category. Then after knowing the overall N-gain from each students, the next step is to analyze the hypothesis test on N-gain of students in the experimental and control classes.
Table 5. T-test analysis of N-gain.

| Group    | Average | T_{count} | t_{table} | Interpretation | Conclusion                  |
|----------|---------|-----------|-----------|----------------|-----------------------------|
| Experiment | 60.53   | 3.98      | 1.67      | T_{count} > t_{table} | Ha was accepted (significant difference) |
| Control   | 52.60   |           |           |                |                             |

Table 5 shows the results of the data analysis on N-gain of students in the experimental and control classes obtained \( t_{count} = 3.98 \) and \( t_{table} = 1.67 \). This proves that \( t_{count} > t_{table} \), so it is concluded that N-gain experiment class and control class have significant differences.

The ARCS model is a learning model that can improve students’ learning motivation, so they can improve their learning outcomes. A form of problem solving approach to design aspects of motivation and environmental learning in encouraging and maintaining student motivation is the ARCS model, because this model consists of attention, relevance, confidence, and satisfaction [9]. This proves that ARCS is a model used by students in solving problems based on the way students build knowledge about the concept of materials provided by the teacher, as to show the motivation of students who come from external conditions.

Learning by using the ARCS model can improve learning outcomes and increase student motivation significantly [10]. Learning science learning outcomes with ARCS models is better than those that follow conventional learning models [11].

3.2. Student motivation

Motivation is a change by the emergence of feelings and reactions to achieve certain goals and as encouragement from within a person. So, it can be concluded that motivation is a process of change in the individual who gives strength to him to behave (with active learning) to achieve his learning goals [1]. The motivational model used in this study is the ARCS Model which is a learning model that can increase learners' motivation which consists of four indicators including attention, relevance, confidence and satisfaction [3].

3.2.1 Attention. The results of student motivation analysis on the attention indicator obtained an average of 4.55. The results of data analysis illustrate that the ARCS model can increase the motivation of students on indicators of attention properly. Attention attracts students by stimulating their interest and curiosity [12], whereas the attention of students refers to curiosity in understanding the concepts in the teaching and learning process. Achieving attention is the most important part of the ARCS model because at this stage it starts to motivate students. Once students are interested in a learning material, they are willing to invest their time to pay attention and find out more [13].

It can be concluded that attention is an activity carried out by someone who is focused on an object. The attention of students in the teaching and learning process is the activities carried out in the classroom that is focused on ongoing learning (there are no other activities undertaken by students).

3.2.2 Relevance. The results of the motivation analysis of students on the indicator of relevance were obtained at a mean of 4.60. The results of data analysis prove that the average obtained can increase students’ learning motivation. The results of previous studies state that relevance must be determined by using language and examples so that students are used to it. Relevance to the material presented is in accordance with the abilities and conditions of students, so that students are able to solve problems that exist in the materials learned [13].

3.2.3 Confidence. The results of the motivation analysis on the indicator of confidence obtained a mean of 4.74 with the criteria strongly agree. This proves that on the indicator of confidence students feel more courageous and able to express knowledge with confidence in learning. The results of previous studies state that the ARCS model can increase student motivation through confidence. The confident aspect of the ARCS model focuses on building positive expectations for achieving success among
students. The level of confidence of students often correlates with motivation and the amount of effort made in achieving learning goals [13].

3.2.4 Satisfaction. The results of the motivation analysis on the indicators of satisfaction (satisfaction) obtained an average of 4.87 with the criteria strongly agree. Satisfaction provides opportunities for students to use the skills and knowledge they have just acquired in real-life situations or simulation settings [12]. The results of previous studies stated that the ARCS model could increase student motivation through satisfaction. Learners must get some type of satisfaction or appreciation from the learning experience. This satisfaction can be from a sense of achievement (good value), or just praise from the teacher. Feedback and reinforcement are important elements and when students value the results, they will be motivated to learn [13].

Based on the results of the research that have been conducted on the study of physics, especially in optical equipment, ARCS models can stimulate students to pay more attention to the lessons and attract interest and improve learning outcomes. The models of ARCS are more effectively used to increase motivation and have a positive effect on learners [14]. The motivation design of ARCS helps to improve students’ overall learning outcomes at the learning level. The increasing student learning outcomes can be seen from the learning outcomes gained after applying the ARCS model [15]. The ARCS model is a valuable tool for increasing student engagement for specific topics taught or delivered instructions. Researchers also suggested that best practices to teach and perform assessments is using the ARCS model for the motivation design [16].

4. Conclusion
Learning outcomes of students after applying the ARCS model shows that there is a significant influence. This can also be proven from the average value in the experimental class through the ARCS model obtained 80.1, while in the control class through conventional learning obtained 66.5. Motivation of students through the ARCS model obtained from four indicators shows that students strongly agree with the learning done through the ARCS model. The results of the four indicators consist of attention obtained 4.55, relevance obtained 4.50, confidence obtained 4.60 and satisfaction obtained 4.74.

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