Practicality and effectiveness of Jigsaw-Modified Learning Models integrated on ARCS (Attention, Relevance, Confidence, and Satisfaction) motivation in Invertebrate material to complete student learning outcomes

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Abstract. This study aims to produce a Jigsaw-modification learning model integrated with ARCS motivation that is valid, practical, and effective with learning tools that support learning. This research is a type of development research with a 4-D (Four-D Models) development model and experimental design of The One Group Pretest and Posttest Design. The preparatory activities were carried out at Postgraduate, UNESA while the trials on 30 students class X MIA-1 students have held at High School 1 Madiun in January 2019 until March 2019. The practicality of the model and the learning tools were reviewed from the classical implementation with an average of 3.95 with very good categories and student activities at 3.6 in the good category. The effectiveness of the model and learning device is based on the results of increasing student motivation gain score learning outcomes of 0.6 with moderate criteria, completeness of 100% learning outcomes with high gain scores. Based on the results of data analysis and discussion of research, it can be concluded that Jigsaw-modification learning models integrated the ARCS motivation that was developed properly, in terms of effectiveness and practicality. Learning models and devices developed can complete student learning outcomes seen from aspects of motivation and improvement in learning outcomes.

1. Introduction

Problems faced by students sometimes cannot be solved alone. Every student has learning problems, abilities, learning styles, types of thinking, different levels of motivation. Besides the demands of the curriculum that requires students to understand the material and connect it to daily life can also form a problem in students. Jigsaw cooperative learning can provide motivation for students to cultivate a good attitude. Jigsaw is learning that can improve metacognition skills and student learning outcomes [1]. In addition to solving learning problems, with Jigsaw students can also solve their social problems.

Classroom learning can build motivation among students. Students will be motivated in learning if there is value in the knowledge presented by the teacher through the learning model and students are optimistic about success [2]. Motivation in the classroom can lead to encouragement, security, and support for students [3]. According to Keller [4], teachers can develop a picture by creating strategies to stimulate and maintain student motivation. Many students have difficulty understanding the concepts that have been given by the teacher, especially in invertebrate material where students have difficulty
distinguishing the characteristics of one invertebrate from one another and distinguishing invertebrates from vertebrates [5]. Studying invertebrates needs to use learning models that are in accordance with the material. The results of the study [6] concluded that using a modified Jigsaw learning model, Jigsaw I Aronson, and Jigsaw II Slavin could improve student learning outcomes by developing a modified Jigsaw learning model. Metacognition skills are measured based on the rubric that is integrated with the problem description, metacognitive awareness using MAI (Metacognitive Awareness Inventory), and cognitive learning outcomes with description test questions measured by the Hart scale. The modified Jigsaw cooperative learning model can increase the ability of students in the lower (AB) academic category to the upper category (AA).

Based on this background, the authors in this study need to study the Development of Integrated Jigsaw-Modification Models of ARCS Motivation in Invertebrate Materials to Improve Student Learning Outcomes.

2. Methods
This research used a quantitative descriptive type. The subject is in one class, that is X MIA-1. The design of the research used One group pretest-posttest which can be described as follows [5]:

\[
O_1 \times O_2
\]

2.1 Analysis of the implementation of problem-solving models
The instrument that was used included observation sheets of implementation of jigsaw-modified models. Activities of the teacher were observed by two observers were sought the mode. Observation of the implementation of the problem-solving model was assessed by observers using a score of 0-4.

2.2 Analysis of Jigsaw-modified
The compilation of the Jigsaw-modified learning model syntax developed is to combine Jigsaw Aronson and Jigsaw Slavin. The modified Jigsaw model has more efficient learning steps or syntax compared to the Jigsaw syntax on Aronson and Slavin. Students need a transition time to move from the original group to the expert group and back to the original group with a very long time and can cause a decrease in student motivation [7]. Aronson and Slavin Jigsaw models need to be reduced and added an element of motivation so as to produce a new learning model that is Jigsaw-modification by applying learning strategies to students. The Jigsaw-modified learning model syntax is (1) Ministro Group (expert group), (2) Colosseum group (origin group), (3) Evaluation, (4) Reward.

Assessment analysis of the results of the feasibility of learning is done by calculating the score according to the reference on the learning feasibility sheet of students was determined using the following formula [5]:

| Score Interval | Category           |
|----------------|--------------------|
| 3,60 ≤ score ≤ 4,00 | Very accomplished |
| 2,60 ≤ score ≤ 3,59 | Accomplished      |
| 1,60 ≤ score ≤ 2,59 | Less accomplished  |
| 1,00 ≤ score ≤ 1,59 | Not accomplished   |

Analysis of student learning outcomes in knowledge competencies was carried out using individual and classical completeness obtained from student’s grade.

\[
\text{Student score} = \frac{\sum \text{value obtained}}{\sum \text{maximum value}} \times 100\%
\]
According to Hake [8], the normalized gain score test is a method of analyzing the improvement of the results of the pretest and posttest. The normalized gain score test category is shown in the table below:

\[
(g) = \frac{\text{posttest score} - \text{pretest score}}{100 - \text{pretest score}}
\]

Furthermore, the N-gain criteria was used to determine the category of critical thinking skills described as: (1) learning outcome with “high gain” if \( g \geq 0.7 \); (2) learning outcome with “medium gain” if \( 0.3 \leq g < 0.7 \); and (3) the learning outcome with “low gain” if \( g < 0.3 \) [7].

3. **Result and Discussions**

The research developed aims to describe the feasibility of learning tools that are valid, practical, and effective. The validity of a device can be seen by the validity of Jigsaw-modification learning model and learning device. Effectiveness is measured by the results of student responses and student learning outcomes during learning using the Jigsaw-modification model integrated with ARCS motivation. Learning with the Jigsaw-modification learning model integrated with ARCS motivation (Attention, Relevance, Confidence, and Satisfaction) can be used as a reference as a source of biology learning, especially in invertebrate and vertebrate submerses in Kingdom Animalia material.

3.1. **Jigsaw-modified model integrated with ARCS motivation learning models lead to learning, such as goals, evolution, environment, and management systems.**

The integrated Jigsaw-modified learning model of ARCS motivation has learning objectives namely individual and group success. Learning outcomes maintain motivation, and students' social skills will develop well. The preparation of the Jigsaw-modified learning model that was developed was to combine Jigsaw Aronson and Jigsaw Slavin. The modified Jigsaw model has more efficient learning steps or syntax compared to the Jigsaw syntax on Aronson and Slavin. The addition of the motivational element is supported [9] theory which compiles a set of motivational principles. The integrated Jigsaw-modified learning model of ARCS motivation is learning that includes activities that are used to carry out learning well. The steps on the modified Jigsaw have been modified. Modification of the steps or syntax of learning on Jigsaw has been reduced from the previous stage and added ARCS motivation so that student motivation is maintained. Students need time to transition from expert groups and to the original group is very long and resulted in decreased student motivation. The Jigsaw-modified syntax integrates ARCS motivation as well as the activities of the teacher and students in each phase. The chairs and tables are neatly arranged in the classroom and easily moved to make learning run well [7].

The learning model is a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve certain learning goals, and serves as a guide for learning designers and instructors in planning teaching and learning activities. The term teaching model refers to a particular approach to instruction that includes its goals, syntax, environment, and management system [7]. The definition of a learning model leads to a specific learning approach including its goals, syntax, environment, and its management system. The model has characteristics such as: (1) logical theological rationales compiled by its creators or developers, (2) the rationale for what and how students learn (learning objectives to be achieved), (3) the teaching behavior needed for the model to be successfully implemented and, (4) the learning environment needed for the learning objectives to be achieved [10].

3.2. **The implementation of Jigsaw-modification model integrated with ARCS motivation**

The implementation of teaching and learning activities and classroom atmosphere is based on the management of teaching and learning activities and classroom management. Student enthusiasm and teacher activities are related to classroom management. Based on the analysis of the implementation of the lesson plan on learning activities carried out in class X MIA 1 has a very good final average of 3.85. Learning resources have a high level of reliability that is \( \geq 0.75 \) (75%) [11] with a very valid category so it can be stated that the learning resources developed are suitable for use in learning because they
show consistent results and are presented with components coherent. Learning resources are sheets containing instructions, the guidance of statements, and understanding so that students can expand and deepen their understanding of the material to be studied [4].

Implementation of learning in the first trial was conducted by 4 observers. The material provided includes Mollusca, Arthropoda, and Echinoderms material of invertebrates. The results of observation of the implementation of the Jigsaw-modification model integrated with ARCS motivation in table 2.

| Aspects                  | Average Meeting I | Average Meeting II | Average Meeting III | Average | Category       |
|--------------------------|-------------------|--------------------|---------------------|---------|----------------|
| Phase 1 - Ministro Group (expert group)- (Attention). | 4                  | 4                  | 4                   | 4       | Very accomplished |
| Phase 2 - Colosseum group (origin group)- (Attention, Relevance). | 4                  | 4                  | 4                   | 4       | Very accomplished |
| Phase 3 - Evaluation- (Confidence, Satisfaction). | 4                  | 4                  | 4                   | 4       | Very accomplished |
| Phase 4 - Reward - (Satisfaction) | 3,25               | 3,5                | 3,75                | 3,5     | Accomplished    |
| Total Average            |                   |                    |                     | 3.75    | Very accomplished |

The learning activities carried out had a very good final average of 3.75 with the very accomplished category. Each activity described in the three materials is adjusted to the syntax of the development of learning models. Each phase has a different average that is in phase 1, phase 2, and phase 3 of 4, and phase 4 of 3.5 with a very accomplished category.

3.3. The learning outcomes using Jigsaw-modification model integrated with ARCS motivation
Learning outcomes are obtained through tests before learning (pretest) and tests after learning (posttest) with the integrated Jigsaw-modification model of ARCS motivation. Before learning, students are given a pre-test to determine the ability of students initial knowledge and after learning given a post-test to find out and check or know the completeness of student learning outcomes. The description of the pre-test and post-test scores of jigsaw-modified will be illustrated in Figure 1.

![Figure 1](Graph of the pretest and posttest with a score of jigsaw-modified)

In class X MIA 1 the average value of pretest and posttest on Mollusca material is 30.8 and 94.1 classically. The Arthropod material, the pretest and posttest were 23.3 and 94.5 respectively. Echinoderms material has pretest and posttest values of 52.9 and 97.9. All three materials have a percentage of completeness at pretest of 8% and posttest of 100% which indicates that each material does not have mastery achievement which is 8% at pretest where students have not been given learning
with completeness criteria that are not complete and 100% complete at the hottest where students have been given learning with completeness criteria that are complete.

Teaching and learning activities are carried out based on the lesson plans that have been developed in the second meeting and the third meeting with higher achievement scores compared to the first meeting because the award is less apparent in the first and second meetings and then corrected in the third meeting. Giving appreciation can maintain student motivation at the end of learning. The awarding is a feedback from the teacher for students which can be in the form of praise to appreciate the hard work of students. In teaching and learning activities there is no real appreciation from researchers such as non-academic matters. However, an award is given to students not only from non-academic aspects but also praise [12]. Group rewards are based on the development of each individual to stay motivated. Giving awards with the title of a good team, great team, and super team in every learning is a motivation and self-development of students to be even better [13]. Two things in cooperative learning that are important are the first by using cooperative learning to improve student achievement while at the same time improving the ability of social relationships, fostering attitudes to accept self-deprivation and others and can increase self-esteem [13]. Second, learning to think, solve problems, and integrate knowledge with skills can be discussed in cooperative learning. Cooperative learning can encourage its members to make maximum efforts to achieve success.

Observing can occur in real objects or simulations that can be used to stimulate students to learn and ask questions. This shows the integrated Jigsaw-modified learning model of ARCS motivation can be used to apply to learn invertebrate material or other material. Each stage is developed using a scientific approach that shows students can find concepts and communicate the results of the discussion. When students are involved in a group, there will be a scaffolding process, where students in one group work together and provide assistance to other group members who are less capable in the learning process [13]. Scaffolding is a learning process where students help other students in the closest zone so that students are able to actually reach their closest potential zone gradually according to the rhythm of learning.

The pretest and posttest data of students who have been obtained are then carried out to gain score test to find out an increase in student learning outcomes between before and after treatment is given [14]. The description of the pre-test and post-test scores of jigsaw-modified will be illustrated in Figure 2.

![Figure 2 Graph of the gained score of jigsaw-modified](image)

The results of the calculation of the gain score test for the 24 students who were given treatment showed that the material on Mollusca and Arthropoda was 0.9 and 0.9 with the criteria for the gain score that was high and the Echinodermata material was 1 with a high gain score criterion. The class that use integrated Jigsaw-modified learning models of ARCS motivation show good results for classroom learning and can improve student learning outcomes. Based on the recapitulation results of learning the three classes above learning using the integrated Jigsaw-modification model of ARCS motivation can be used properly in the classroom.
Group learning is learning that involves students to be active in groups. Learning in which there are students who are active in groups and communicating with their environment to seek knowledge is learning student center. Learning with good student activities also supports the completeness of student learning outcomes well too. In addition to the completeness, student learning outcomes also improved which can be seen from the value of the pretest and posttest on each material provided. After learning to use the integrated Jigsaw-modified learning model ARCS, students' understanding of the concepts taught has increased with a high category based on the results of the gain score test from the pretest to the posttest score. Modification jigsaw is a model developed for learning activities that helps students easily achieve their knowledge with effective time and with integrated motivation ARCS can maintain student motivation from the beginning to the end of learning.

Students express their ideas better as a result of cooperation and an environment where they can discuss ideas easily created. It was revealed thanks to students' opinions that in a laboratory environment where teacher efficiency is increasing in class and teacher accessibility becomes easier for unsolved problems; any learning deficiencies resulting from the uproar disappear [12]. A study conducted to students shows that Jigsaw-modified learning can be used to practice the ability in metacognition skills with efficient time and social interaction combined with ARCS motivation that can maintain student motivation from the beginning to the end of learning. These results show the superiority of the integrated Jigsaw-modified learning model of ARCS motivation in completing student learning outcomes [13].

4. Conclusions
Based on the results of data analysis and discussion of the research, it can be concluded that the Jigsaw-modification learning model integrates the ARCS (Attention, Relevance, Confidence, and Satisfaction) motivation which is feasible, in terms of effectiveness and practicality. Learning models and devices developed can complete student learning outcomes seen from aspects of attitude and knowledge. Future studies can use the Jigsaw-modification learning model integrated with ARCS motivation (Attention, Relevance, Confidence, and Satisfaction) on other materials so that student learning outcomes can increase. The time allocation used should be adjusted to the learning activities taking place. Skill assignments resulting from group drawings are given assignment limitations.

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