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# The Development of Revised Jigsaw Collaborative Learning Model in Physics Subject at Universitas Negeri Gorontalo

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**Abstract**

The purpose of this study is to develop the collaborative learning model of Revised Jigsaw (henceforth will be called as Jire) in Basic Physics 2 subject at Department of Physics. This is a research and development study that refers to the design of the 4-D model according to Thiagarajan, Semmel, and Semmel that is consisted of define, design, develop and disseminate. The result indicates that Jire collaborative learning model that has been developed is (1) valid and feasible based on the expert; (2) able to improve students' responses in the learning process. Further, learning process applying Jire model is in a very good criterion; (3) able to improve students' activities and learning outcomes in which the observation result shows that students' activities arrive at 95% for the limited trial class, and the average percentage for the field trial class reaches 97.3% with a very good criterion, (4) students' learning outcomes provide a classical mastery that the limited trial class achieves 90%, and the average percentage for the field trial class is 96% with a very good criterion. Accordingly, Jire collaborative learning model that has been developed is valid, practical, and effective in order that it can be used in Basic Physics 2 subject.

**Keywords:** Collaborative, Revised jigsaw (Jire), Basic physics

## 1. Introduction

Education is a means to improve the quality of human resources and has become one of the benchmarks of nation progress. The implementation of education is intended to equip citizens with skills, knowledge, and insights to develop their potential. Through education, everyone can compete in facing globalization and involve in a nation development and improvement, so that it will not be left behind by other nations. This purpose will be able to be achieved if the education is well-implemented.

In order to avoid a great competition that can destroy each other when the earth population is getting higher compared to the earth's capability to provide foods in the changing climate patterns, Makiguchi (2003) offers a humanitarian competition that values diversity. This attitude should be started with little things, such as collaborative learning and recognizing an interconnected existence and depends on others that emphasize the aspect of cooperation in life.

The concept of collaborative learning is a potential learning method to meet the challenges as well as to offer a way of resolving problems by involving related participants collectively in a group. Bruffe (1995) argues that knowledge is something that builds cooperative learning constructed by talking together and reaching an agreement. Collaborative learning is advantageous to improve students' creative thinking and collaborative working (Ismayati, 2018).

Such groups of learners do a collaborative learning as in accordance with their competence. They can reduce a partial solution and improve the quality of integrity through communication pattern and exchanging idea, point of view, and research result. A partial solution is inappropriate to some times and places, yet it needs a spectrum of holistic solution depending on time and place suitability.

Students' active involvement in the learning process can affect their learning outcomes. A study conducted by Santoso (2013) reveals that collaborative learning applied in the learning process is able to improve students' learning outcomes along with their thinking skill (Dewi, Rosmalia, & Murdiyah, 2016).

One of the collaborative learning models is Jigsaw that is able to encourage students to actively involve in the learning process. Through the use of this technique, students naturally develop their interest in working with their friends as well as learning and developing good attitudes from each other (Adams, 2013). Jigsaw-typed collaborative learning leads students to learn and accept things presented by lecturers, to teach and learn from other students.

Several previous studies show that the Jigsaw method can improve students' learning activities and outcomes in every level of education (Aronson, 2005; Killic, 2008). The findings pertaining to students' views towards Jigsaw method argue that this method has positive impacts on students in various ways, but it also acknowledges the existence of negative impacts which should not be disregarded. The positive views towards the method help foster a sense of group identity and a supportive learning environment (Slavin, 1996). However, in light of the negative views, teachers should take into account these problems

because they may lead students to dislike working cooperatively as it may not be the best instructional design for some of them (Arra, D'Antonio, & D'Antonio, 2011).

Based on the preliminary observation and researchers' personal experiences in employing Jigsaw method, the main weakness of this model in addition to the time-consuming implementation (Ntobuo, 2014) is the incorrect students' discussion result. When the expert group returns to their original groups, their discussion result has not yet been correct and accurate, so that the lecturers' role is highly required to direct the answer/discussion result of each expert group before sharing the information with the original groups. This has become the major reason for developing Jigsaw learning model. Regarding this, there will be an analysis and revision of the existed stages in order that the weaknesses of Jigsaw can be lessened, and improving the use of such a learning model.

## 2. Method of Study

This research and development study refers to the design of the FOUR D model according to Thiagarajan, Semmel, and Semmel (Trianto, 2009) that is consisted of define, design, develop and disseminate. The product developed in this study is the collaborative learning model of Jire. This study was conducted in the second semester of the academic year of 2017/2018. Moreover, the trial test was carried out to 15 students at the Department of Physics, and the field test was conducted in three classes in the same department of Universitas Negeri Gorontalo.

This study used several instruments, including 1) Expert validity sheet to assess the handbook of Jire collaborative learning model. The validity was performed by two Physics learning experts and two learning evaluation experts, 2) Expert validity sheet of Jire-typed collaborative learning media was done by two Physics learning experts and two learning evaluation experts, (3) Questionnaire to obtain the data of students' responses about the application of Jire collaborative learning model, 4) Observation sheet of students' activities and 5) Test of Learning Outcome.

Data analysis in this study is described as follows.

### *2.1 Analysis of Validity*

The results of expert validity were analyzed by referring to the validity criteria in Table 1.

Table 1. Validity criteria

| Average | Validity criteria |
|---|---|
| 4.00 - 3.75 | Very Valid |
| 3.75 - 3.00 | Valid |
| 3.00 - 2.25 | Quite Valid |
| 2.25 - 1.50 | Invalid |

Source: Sukardi, 2013.

Based on the table, Jire learning model can be applied in the learning process if it meets the valid or very valid criterion as in accordance with the experts' assessment.

*2.2 Analysis of Students' Responses and the Implementation of The Learning Process*

The analysis steps of the questionnaire in regards to students' responses are: (a) consisting of 1-4 scale for a positive statement: very disagree = 1, disagree = 2, agree = 3, very agree = 4 as well as a negative statement: strongly disagree = 4, disagree = 3, agree = 2, strongly agree = 1; (b) Calculating total students who answer the questions in every aspect from scale 4 to 1, and (c) Calculating the percentage of total students (%) who answer the questions in every scale (from 4 to 1) for every aspect.

The assessment of learning process implementation was carried out by matching the given average results of total score with the following criteria:

Table 2. Criteria of learning process implementation

| Score range | Interpretation |
|---|---|
| 86% - 100% | Very good |
| 76% - 85% | Good |
| 66% - 75% | Fair |
| 56% - 65% | Poor |
| 0% - 55% | Very Poor |

Source: Sukardi. 2013.

*2.3 Analysis of Learning Activities and Learning Outcomes*

The assessment of students' activities was done by matching the obtained average results of total score with the criteria in Table 2. Similarly, students' learning outcomes were analyzed by referring to the individual mastery of 80% and classical mastery converted to the criteria in Table 2.

## 3. Results and Discussion

This study creates a product in the form of the handbook of Jire collaborative learning model along with its learning media. This development is carried out with several stages referring to the development model of the FOUR D described as follows:

In the stage of Define, needs analysis was performed towards the interview results with the lecturer of Basic Physics subject and students who enroll in this subject. A good learning model that can improve students' learning outcomes and social skills is required in this subject. Referring to the result of this study, Jigsaw model is an effective method to improve students' activities, yet it has not been optimal in improving their learning outcomes. After conducting a reflection, it is found that the expert group's explanation has not yet reached a good result in which their answers are not completely correct.

According to the result of the Define stage, the researchers develop the collaborative learning model of Jire in the Design stage. In this stage, the stages of Jire collaborative learning model are developed as the completion of Jigsaw model. Besides, learning media are also evolved to be used in applying such a learning model in the learning process. Below are the stages of Jire collaborative learning model.

Table 3. Hypothetical model of Jire collaborative learning

| No. | Stages of collaborative learning | Stages of JIRE learning | Stages of JIRE collaborative learning | Info |
|---|---|---|---|---|
| | Orienting students/delivering learning motivation and objectives | | Orienting students/ delivering learning motivation and objectives | JIRE Collaborative |
| | Forming groups | Reading. Students get the topic and read the learning material in their original groups to find information | Forming groups:<br>Reading. | Collaborative<br>JIRE |
| | Compiling learning assignments | Expert group discussion. Students with the same expertise meet each other to discuss it in the expert group | Discussion | Collaborative<br>JIRE |
| | Facilitating students' collaboration | Each expert group discusses the findings with the lecturer to check the correctness of their findings. | Facilitating students' collaboration: Each expert group discusses the findings with the lecturer to check the correctness of their findings. | Collaborative JIRE |
| | | Group's report. The experts return to their original groups to teach their topics to the group members. | Group's report. The experts return to their original groups to teach their topics to the group members. | |
| | | Doing a quiz to check the accuracy of the work of the original group | Doing a quiz to check the accuracy of the work of the original group | JIRE |
| | | Reviewing Process | Reviewing Process | JIRE |
| | Giving scores and evaluating the collaborative learning Rewarding | Giving tests and rewarding | Giving tests, rewarding, and evaluating the collaborative learning | Collaborative /JIRE |
| | | Re-teaching | Re-teaching | JIRE |

Based on the above hypothetical model, the stages of Jire collaborative learning model are presented in the following Table 4.

Table 4. Stages of JIRE collaborative learning

| No. | The model stages |
|---|---|
| 1 | Orienting |
| 2 | Grouping |
| 3 | Reading |
| 4 | Expert group discussion |
| 5 | Facilitating students' collaboration |
| 6 | Giving scores and evaluating |
| 7 | Group's report |
| 8 | Quiz |
| 9 | Reviewing Process |
| 10 | Rewarding |
| 11 | Re-teaching |

In addition to developing Jire collaborative learning model, learning media is also evolved to apply this Jire model.

The next stage is Develop consisting of expert validity and product trial. Expert validity is performed by physics learning and learning evaluation experts. The validity of Jire model and its learning media contain various assessment parameters in terms of the construction, content and language, legibility and appearance. The obtained validity results are a qualitative suggestion and an assessment sheet. The qualitative suggestion is used as a reference to revising the handbook of Jire collaborative learning model along with its learning media. After revised, the experts fill out the assessment sheet that its results are shown as follows.

Table 5. The validity results of the handbook of learning model and media

| No. | Learning media | Assessment category | Feasible /infeasible |
|---|---|---|---|
| 1 | Learning Model Handbook | Very Valid | Feasible |
| 2 | Learning Syllabus | Very Valid | Feasible |
| 3 | Lesson Plan | Very Valid | Feasible |
| 4 | Students' Worksheet | Very Valid | Feasible |
| 5 | Teaching Materials | Valid | Feasible |
| 6 | Learning Outcome Test | Valid | Feasible |

The above table indicates that the handbook of Jire collaborative learning model and its

learning media is in the very valid and valid category, which therefore, it is feasible to be applied in the learning process.

After validated, limited and broad trials of the application of Jire collaborative learning model are conducted. Below is the result of limited and broad trials of the application of Jire collaborative learning model, including students' responses and the implementation of learning process employing Jire model as well as students' activities and learning outcomes.

*3.1 Students' Responses and the Implementation of the Learning Process by Using Jire Collaborative Learning*

In the limited trial, students' responses towards the application of Jire collaborative learning model are presented as follows.

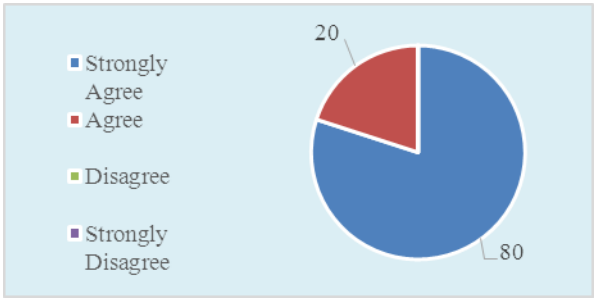


Figure 1. Students' responses in limited trial class

Figure 1 indicates that 80% of the students very agree, and the other 20% agree with the application of Jire collaborative learning model in Basic Physics 2 subject. Further, no students do not agree with this learning model. The reflection result at the end of the class reveals that these 20-percent students find it difficult to re-explain the results of the expert group due to their lack of confidence. Thus, in the broad trial, the lecturer should motivate the students to be more confident in explaining the learning materials obtained from the original groups.

Below are the analysis results of students' responses in the broad trial of the application of Jire collaborative learning model.

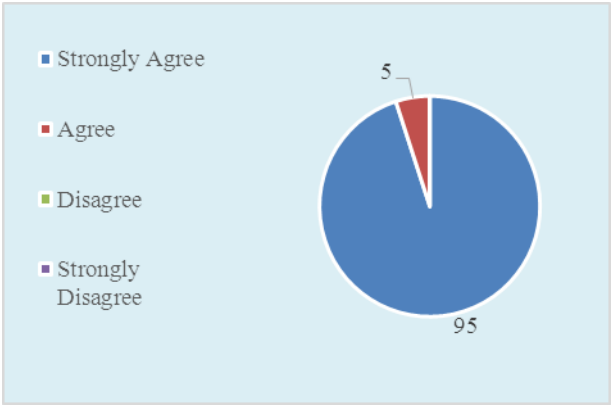


Figure 2. Students' responses in broad trial class

Figure 2 shows that 95% of the students very agree, and the other 5% agree with the application of Jire collaborative learning model in Basic Physics 2 subject. Further, no students do not agree with this learning model. This indicates that Jire collaborative learning model is practically used in Basic Physics 2 subject.

This result is in line with a study conducted by Juliana and Surya (2017) stating that Jigsaw model is able to enhance students' responses and confidence in the learning process. This is also supported by Herawaty (2017) who notes that Jigsaw learning model can improve students' responses in the learning process, and the lesson becomes interesting when students work together. It is because they get many suggestions from the members of the group. However, a recurring theme found in their negative views towards Jigsaw model is that they are reported having free-riders in their group, in which some of them refuse to give their full cooperation in the original and expert groups' discussion (Azmin, 2016).

The development of Jire collaborative learning model can lessen this weakness. Through the lecturer's guide in the expert group to determine the correct answers, every student will be motivated and actively involved in the learning process. Accordingly, Jire collaborative learning model as the completion of Jigsaw model is able to improve students' responses in the learning process.

From the aspect of the implementation of Jire collaborative learning model, the limited trial class reaches the average percentage of 90%, meanwhile, the broad trial class arrives at the percentage of 100% as presented in the following diagram.

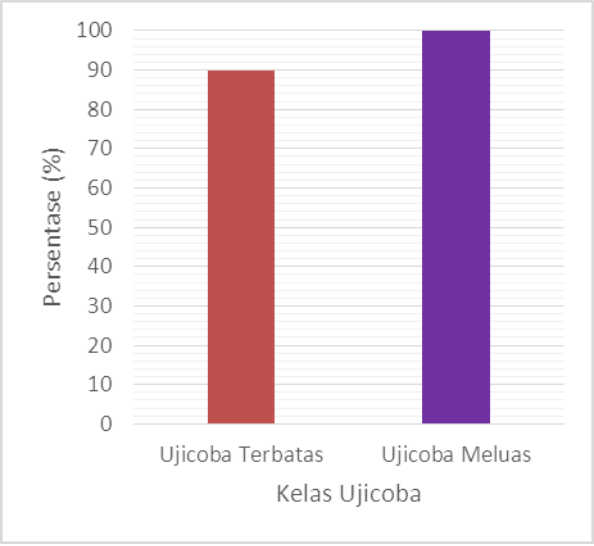


Figure 3. Percentage of the implementation of learning model

Figure 3 reveals that 90% of the stages of Jire learning model are applied in the limited trial, yet it goes up to 100% in the broad trial. It means that the implementation of Jire collaborative learning model is in a very good criterion. This model is considered practical and easy to apply in Basic Physics 2 subject.

*3.2 Students' Activities*

The observation result of students' activities during the learning process arrives at 95% and 97.3% in the limited and broad trial classes respectively, implying that both trials are in a very good criterion. The following is the percentage diagram of students' activities during the learning process in both classes.

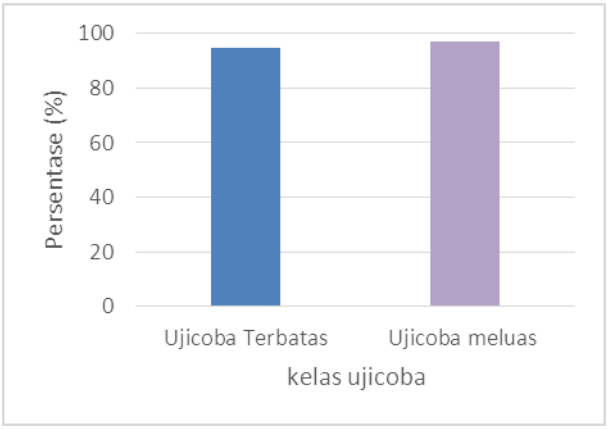


Figure 4. Percentage of students' activities

Based on Figure 4, students' activities are in a very good criterion, indicating that Jire collaborative learning model is able to enhance students' activities in the learning process.

Various studies on Jigsaw model also give similar data, for example, it can improve students' activity performances in learning as resulted by Gambari (2016). This result is also in compliance with Musthofa (2013), Sarwanto and Masithoh (2013) who claim that Jigsaw learning model is able to enhance students' activities in the learning process. This shows that Jire collaborative learning model is the completion of Jigsaw model that can effectively improve students' activities in learning.

*3.3 Students' Learning Outcome*

Jigsaw is an effective learning model to improve students' ability in solving problems (Hertiavi, Langlang, & Khanfiyah, 2010) that is impactful on their learning outcomes. A study conducted by Trisianawati, Djudin, and Setiawan (2016) also reveals that the application of Jigsaw learning model is quite taking effect on the improvement of students' learning outcomes.

Besides, Karacop (2017) also indicates that Jigsaw learning model can make students have a higher achievement level in Physics, in which it is also supported by Y.-M. Huang, Y.-W.Liao, S.-H. Huang, and H.-C. Chen (2014) stating that Jigsaw model is able to increase students' learning outcomes.

Although some studies show an improvement of students' learning outcomes through Jigsaw learning model, Dollard and Mahoney (2010), in contrast, figure out that there is a 0.9% test score improvement in favor of the Jigsaw method and notes that it is not enough to determine

whether or not the method is more effective than the traditional method of learning. For that reason, Jire collaborative learning model as the completion of Jigsaw model is developed that it can improve students' learning outcomes as evidenced by the results of the limited trial and broad trial in the following Figure 5.

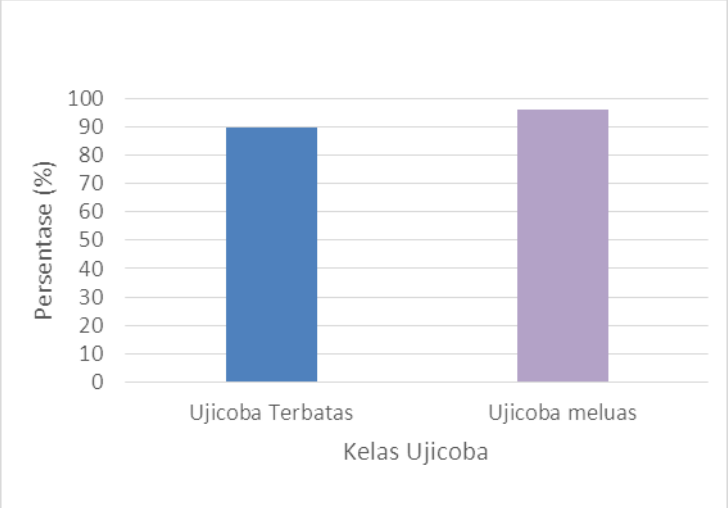


Figure 5. Percentage of students' learning outcome mastery

It is seen in the above figure that the percentage of students' learning outcome mastery in the limited trial class and broad trial class is 90% and 96% respectively. This proves that Jire collaborative learning model is an effective way to increase students' learning outcomes in Basic Physics 2 subject. This is in line with Tran and Lewis (2012) in which the main findings of their study support the effectiveness of Jigsaw learning model for students.

Dissemination stage is performed by employing Jire collaborative learning model in the broader process of learning, i.e. distributing the handbook of this revised model.

## 4. Conclusion

Some conclusions of this study are drawn, as follows: (1) Jire learning model is in a valid and feasible category based on the expert; (2) Jire learning model can improve students' responses in the learning process. Further, learning process applying Jire model is in a very good criterion; (3) it is able to improve students' activities and learning outcomes in which the observation result shows that students' activities arrive at 95% for the limited trial class, and the average percentage for the field trial class reaches 97.3% with a very good criterion, (4) students' learning outcomes provide classical mastery that the limited trial class achieves 90%, and the average percentage for the field trial class is 96% with a very good criterion.

## 5. Suggestion

Jire Collaborative learning is a new model developed from Jigsaw Cooperative learning. For that reason, further studies are required in order to find out the effectiveness of such a model, both in different subjects and education levels.

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