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DEVELOPING AN IT-BASED JIRE COLLABORATIVE LEARNING MODEL DEVICE FOR THE MOMENTUM AND IMPULSE MATERIALS TO ELEVATE SENIOR HIGH SCHOOL STUDENTS' LEARNING OUTPUTS

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ABSTRACT:

This research sets a focus on developing an IT-based Jire collaborative learning model device for teaching physics in senior high schools. This is development research using a 4-D design model proposed by Thiagarajan, Semmel, and Semmel. The model comprises four stages, i.e., define, design, develop, and disseminate. The results manifest that (1) the IT-based Jire collaborative learning model device for the momentum and impulse materials is valid and reliable to use in the learning process, (2) the IT-based Jire collaborative learning model is practical to use in the learning process and effective to escalate students' responses to physics, particularly the momentum and impulse materials. Additionally, learning implemented using the Jire collaborative learning is considered good, and (3) the IT-based Jire collaborative learning model is efficient to enhance students' learning activities and outputs, where based on my observation, the students' activity percentage is 90% above. The percentage of the students' learning outputs is 80-100%. The result is indicative of the validity, practicality, and effectiveness of the IT-based Jire collaborative learning model in physics learning, principally the momentum and impulse materials.

Keywords: collaborative, jire (jigsaw revised), physics, senior high school.

INTRODUCTION:

In classroom learning, most teachers apply certain learning methods and atmosphere, which we can analogize as saving activities and a system of competition. Accordingly, collaborative learning is employed to both resolve the issue and improve students' collaborative skills. Santoso, S. (2013) argues that collaborative learning implemented in the learning process increases students' learning outputs. One of the collaborative learning models is Jigsaw revised (Jire), the topic of which I have developed in my previous research, which points out that the Jire collaborative learning model can boost students' active engagement in learning and promote their learning outputs (Ntobuo, Nova., Enos, Taruh., Hulukati, Evi., dan Lukum, Astin; 2018).

Collaborative learning constitutes a method of how to drive students' active engagement and how to settle various problems by involving them to participate in a group. Bruffle (1995) contends that knowledge is something people cooperative learning construct by talking together and reaching an agreement. Collaborative learning is advantageous to improve the students' creative thinking and collaborative working (Ismayati, 2018).

Students' active engagement in the learning process elevates their learning outputs. Santoso (2013) posits that collaborative learning, which encourages students to be active learners, can enhance their learning outputs. The use of the collaborative learning

model escalates not only students' learning outputs but also their creative thinking (Dewi et al., 2016).

One of the collaborative learning models is Jigsaw. This model fosters students' active engagement in the learning process. Through the use of the technique, pupils naturally developed an interest in working with their colleagues, and through that, they learnt from each other and hence learnt better. They also cultivated good attitudes from each other (Adams, 2013). In the Jigsaw collaborative learning, students are induced to learn from and teach their peers, rather than take the learning material for granted.

Previous research presents the result that the Jigsaw method improves students' learning activities and outputs at different education levels (Aronson, 2005). The findings pertaining to students' views towards the Jigsaw method suggest that this method has a positive impact 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 consideration the stated problems because these hiccups may lead students to dislike working cooperatively as it may not be the best instructional design for some (Arra, D'Antonio, and D'Antonio, 2011).

Based on my analysis and experience when I am using the Jigsaw learning model, several weaknesses are exposed, one of which is the long time called for its implementation (Ntobuo et al., 2014). Another serious weakness is that when the expert group returns to the origin group, the first group's answers/discussion results cannot be declared as correct. As such, in this phase, a teacher should be present to evaluate the answers/discussion results before sharing the information with the origin group. The two weaknesses underpin the development of the Jigsaw learning model. In my previous research, I have fixed the weaknesses through a learning model developed from a Jire collaborative learning model. This model is valid, practical, and effective for the learning process, specifically at the senior high school level. Building on the background, I carry out research in SMA Negeri 2 Gorontalo City by implementing the Jire collaborative learning model in the momentum and impulse materials. This research engages IT, given because of the COVID-19 pandemic, learning should be online, demanding learning devices which can be accessed by students anytime and anywhere and are adjusted to the current global condition.

METHODOLOGY:

This research adopts the development model by Thiagarajan, Semmel, and Semmel (Trianto, 2009). The model consists of four stages, namely define, design, develop, and disseminate. The product of this research is an IT-based Jire collaborative learning model device for the momentum and impulse materials. This research is conducted during the odd semester academic year of 2021/2022. Validation tests are executed by a learning expert and an IT multimedia one. A limited tryout is performed on 34 students of X IPA 1 SMA Negeri 2 Gorontalo.

Instruments used in this research are (1) a validation sheet for the learning expert to assess the learning device made by applying the Jire collaborative learning model, (2) a validation sheet for the IT multimedia expert to assess the IT multimedia used, (3) questionnaires to collect students' responses to the implementation of the IT-based Jire collaborative learning model, (4) an observation sheet of learning implementedness using the IT-based Jire collaborative learning

model, (5) an observation sheet of students' activities, and (6) a learning outcome test.
The data analyses of this research are:

1) Validity Analysis:

The validation of the IT-based Jire collaborative learning model device is shown in Table 1.

Table 1 Validation Criteria for the Learning Device

Percentage (%)	Validation Criteria	Category
76 – 100 %	Valid	Reliable
56 – 75 %	Moderately valid	Moderately reliable
40 – 55 %	Slightly valid	Slightly reliable
0 – 39 %	Not valid	Not reliable

(Trianto, 2009)

Predicated on Table 1, the IT-based Jire collaborative learning model device is reliable if considered valid or strongly valid by the experts.

2) Analysis of Students' Responses and Learning Process Implementedness:

To analyze the students' responses to learning implementedness using the IT-based Jire collaborative learning model, the analysis stages are (a) giving a score to every student option. The score range is 1-4 for a positive statement: strongly disagree = 1, disagree = 2, agree = 3, strongly agree = 4 and for a negative statement: strongly disagree = 4, disagree = 3, agree = 2, strongly agree = 1, (b) quantifying the total number of students who give responses to all aspects from a scale of 4-1, and (c) quantifying the total percentage (%) of students who give responses on each scale (4-1) for all aspects.

The determination of learning implementedness criteria refers to Table 2.

Table 2 Learning Implementedness Criteria

Score Range	Intepretation
86% - 100%	Very good
76% - 85%	Good
66% - 75 %	Acceptable
56% - 65%	Poor
0% - 55%	Very poor

(Sukardi, 2013)

3) Analysis of Learning Activities and Outputs:

Students' activities are assessed referring to the criteria in Table 2. Students' learning outputs are analyzed referring to individual completeness of 80% and classical completeness conversed using the criteria in Table 2.

RESULT AND DISCUSSION:

This research generates a product of a learning device implementing the IT-based Jire collaborative learning model in physics, especially the momentum and impulse materials. The product is developed in the stages referring to the FOUR D development model as follows:

In the define stage, a need analysis takes place by interviewing teachers and students on the topic of the current learning process and problems occurring in the process. The interview results are used to undertake a need analysis of students and teachers.

Based on the result from the define stage, in the design stage, I develop an IT-based collaborative learning model device. Table 1 showcases the syntax of the Jire collaborative learning model. The syntax becomes my reference to make the learning device.

Table 3 The Syntax of the Jire Collaborative Learning Model

No.	Syntax of the Model
1	Orienting
2	Grouping
3	Reading
4	Discussion by the expert group
5	Facilitating student collaborations
6	Assessing and evaluating
7	Team reporting
8	Quiz
9	Reviewing
10	Giving appreciations and rewards
11	Re-teaching

After the IT-based Jire collaborative learning model device for the momentum and impulse materials is made, the next stage is the develop one, in which validation tests and a limited tryout are taken up to the product.

The validation tests are carried out by a physics learning expert and an IT-based learning expert. The results of the validation are qualitative suggestions and assessment sheets. The qualitative suggestions are used to re-revise the IT-based Jire collaborative learning mode device. After the revision, the experts fill the assessment sheets, which are shown off in Table 4.

Table 4. Validation of IT-based Application and Learning Device

No.	Learning Device	Assessment Category	Reliable/Not Reliable
1	Syllabus	Very valid	Reliable
2	Lesson plan	Very valid	Reliable
3	Student worksheet	Very valid	Reliable
4	Learning material	Valid	Reliable
5	Learning output test	Valid	Reliable
6	IT application	Valid	Reliable

Building on Table 4, the IT-based Jire collaborative learning model device for the momentum and impulse materials is very valid and valid and hence reliable to use in the learning process in senior high schools.

After the validation tests, a limited tryout is carried out in SMA Negeri 2 Gorontalo City. Here are the limited tryout results, covering students' responses, learning process implementedness using the Jire collaborative learning model, and students' learning activities and outputs.

1. Students' Responses and Learning Process Implementedness Using the Jire Collaborative Learning Model:

Table 5 demonstrates students' responses to the learning process.

Table 5. Students' Responses to the Learning

Criteria	Average Percentage (%)
Very good	29.4 %
Good	70.6 %
Acceptable	0.00%
Poor	0.00%
Very poor	0.00%

As exhibited in Table 5, students' responses to the learning are good and very good, indicating that the Jire collaborative learning model is practical to use in the learning process. It is aligned with Tumanggo et al. (2018), that students give a positive response to the use of the Jigsaw cooperative learning model. It is analogous with Herawaty (2017), that the Jigsaw learning model can elevate students' responses in a learning process. The lesson becomes interesting when students are working together because they get many suggestions from the people in the group. However, a recurring theme found in their negative views toward the Jigsaw strategy was that they reported having free-riders in their group, in which some students refuse to give their full cooperation in the home and expert group discussions (Azmin, 2016).

The Jire collaborative learning model developed will address the weakness. Assisted

to choose the correct answers, students will be motivated and more active in the learning process and thereby giving good responses to the Jire collaborative model, which has mended the Jigsaw learning model, as indicated in this research.

Learning implementedness using the IT-based Jire collaborative learning model is manifested in Figure 2.

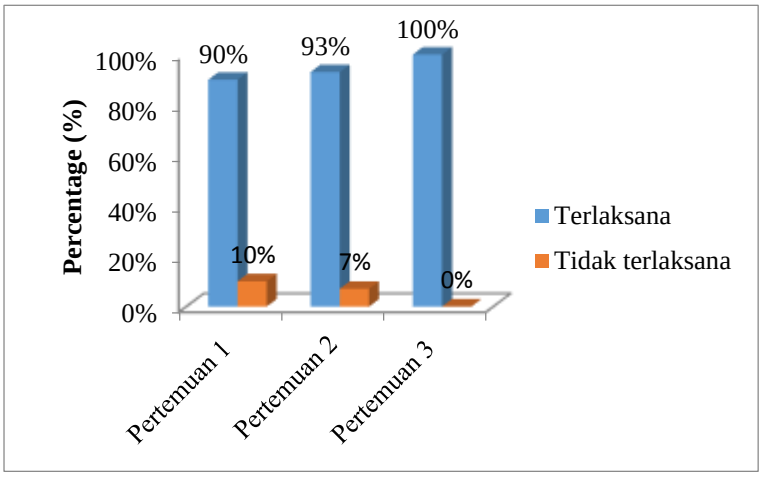

Figure 2. The Percentage of Learning Model Implementedness

As indicated in Figure 2, in Meeting 1, 2, and 3, the learning process implementedness percentage is 90%, 93%, and 100%, or in a very good criterion. Therefore, the average percentage of learning implementedness using the IT-based Jire collaborative learning model is 94.33%, or in a very good criterion. The percentage is indicative of the practicality of the IT-based Jire collaborative learning model in the learning process. Ntobuo et al. (2018) lay out that the Jire collaborative model can be well implemented in physics learning. Collaborative learning is part of learning which emphasizes student cooperation conducted by self-made groups who seek solutions to the assignment/problem given by teachers. A good learning model and proper classroom implementation will breed good learning process implementedness.

2. Students' Activities:

12 indicators are observed to identify students' activities during learning using the IT-based Jire collaborative learning model.

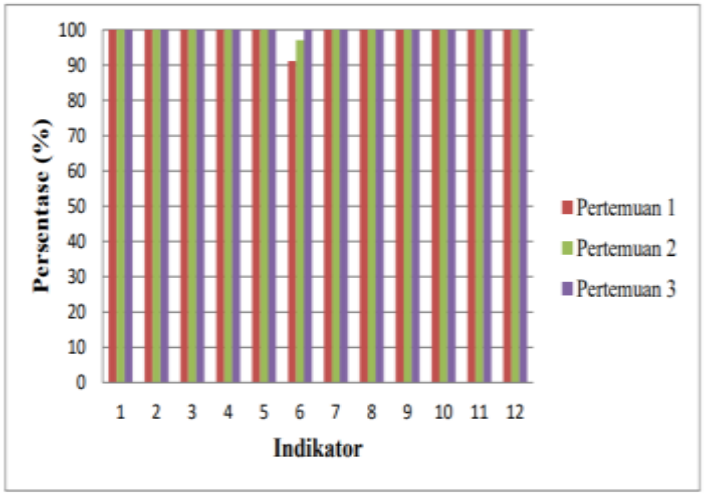

Figure 3. The Percentage of Students' Activities

Based on Figure 3, in general, students' activities in each meeting have a percentage of above 90%, indicating a good implementation of physics learning using the Jire collaborative learning model. The result is aligned with Lasidos and Matondang (2015) research, in which they argue that collaborative learning is effective to elevate students' learning output. Gambari (2016), who analyzes the Jigsaw learning model, affords the same data and contends that the learning model enhances students' activities and performance when learning. Collaborative learning is part of learning which highlights students' cooperation and is carried out by a self-made group and solves tasks/problems from teachers. The model draws students' interests as they can actively participate in the learning process and solve the tasks given by teachers collaboratively. It demonstrates that the Jire collaborative learning model, which constitutes an improved version of the Jigsaw learning model, is effective to escalate students' activities in the learning process.

3. Students' Learning Output:

Some research exhibits that the implementation of the Jigsaw collaborative learning model has a positive effect on the learning process. Gillis (2003) posits that the Jigsaw learning model improves students' learning outputs. Correspondingly, Karacop (2007) indicates that the Jigsaw learning model allows students to achieve higher in physics. Seni, Minggu, and Kaleka (2018) adds that the Jigsaw cooperative learning model can increase students' learning output.

The research is indicative of a positive impact of the Jigsaw cooperative learning model on learning. And yet, Dollard and Mahoney (2010) find that there were 0.9% test score improvements in favor of the Jigsaw method and contended that it was not enough to determine whether the method was more effective than the traditional method of learning. Considering the latter argument, the Jire collaborative learning model, which is the Jigsaw cooperative learning model developed, completes the previous learning model's drawbacks.

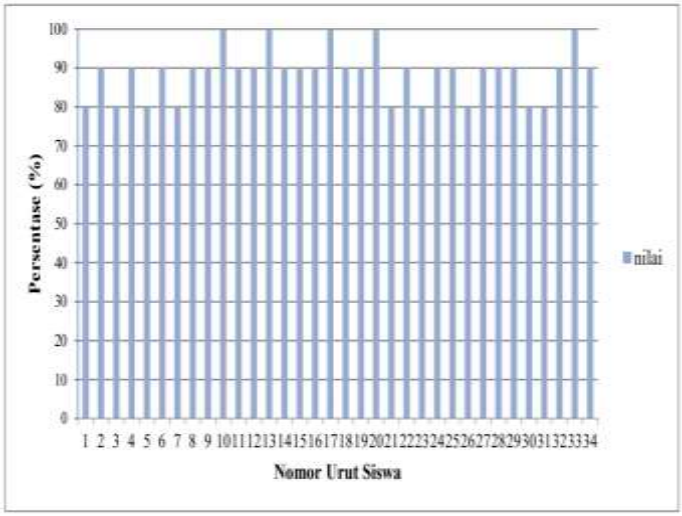

Figure 4. The Percentage of Students' Learning Outcome

As manifested in Figure 4, students' learning outputs are in a range of 80%-100%. It points out that the implementation of the Jire collaborative learning model is effective to use in the physics learning process, notably the momentum and impulse materials. The result supports the previous research and rectifies the paucity.

CONCLUSION:

Building on the result and discussion, (1) the IT-based Jire collaborative learning model device for the momentum and impulse materials is valid and reliable to use in the learning process, (2) the IT-based Jire collaborative learning model is practical to use in the learning process and effective to escalate students' responses to physics, particularly the momentum and impulse materials. Additionally, learning implemented using the Jire collaborative learning is considered good, and (3) the IT-based Jire collaborative learning model is efficient to enhance students' learning activities and outputs, where based on my observation, the students' activity percentage is 90% above. The percentage of the students' learning outputs is 80-100%. The result is indicative of the validity, practicality, and effectiveness of the IT-based Jire collaborative learning model in physics learning, principally the momentum and impulse materials.

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