World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

The effectiveness of cooperative learning model with inquiry approach for static fluid materials at SMA Negeri 1 Kabila, Indonesia

Aswan Bannang *, Ritin Uloli and Tirtawaty Abdjul

Physics Education, Postgraduate Program, Universitas Negeri Gorontalo.

World Journal of Advanced Research and Reviews, 2024, 21(01), 1030–1038

Publication history: Received on 26 September 2023; revised on 08 November 2023; accepted on 10 November 2023

Article DOI: https://doi.org/10.30574/wjarr.2024.21.1.2307

Abstract

This research aims to engender effective learning devices using a cooperative learning model with an inquiry approach for static fluid materials. Developing learning devices using a cooperative learning model with an inquiry approach generated products of a lesson plan, learning material, student worksheet, and learning outcome test. The results of validation conducted by two validators exhibited that the learning devices were valid, and each product had a percentage of 85.01-100%. The limited group test, executed to identify 15 students' responses to the learning devices, resulted in score percentages of 98.33% for the lesson plan, 98.52% for the learning material, 99.33% for the student worksheet, and 99.33% for the learning outcome test. Overall results indicated that the learning devices were very effective for learning. The effectiveness was implied by the mean assessment scores of responses given by eleventh graders from the Science 4 class as participants as follows: 95.83% for the cooperative learning model, 99.72% for the student worksheet, 98.77% for the learning material, and 97.78% for the evaluation tool. A similar analysis performed on eleventh graders from the Science 5 class generated score percentages of 95.83% for the cooperative learning model, 96.67% for the student worksheet, 94.75% for the learning material, and 94.72% for the evaluation tool. In terms of learning outcome tests, eleventh graders from the Science 4 and 5 classess acquired N-Gains of 0.760 and 0.783 (a high category), respectively.

Keywords: Effectiveness; Learning Device Development; Cooperative Model; Inquiry Approach; Static Fluid

1. Introduction

Education is an effective solution to the current issue in Indonesia, but evidence suggests tardiness in positioning education as a tool to solve national problems (Uno, 2014). Education, instead of being static, runs dynamically, calling for continuous improvements. The education world sets a goal which has to be achieved through a learning process.

Sudjana (2012) argues that education constitutes a deliberate effort by educators to allow students undertake a learning activity. Hermawan (2013) conveys that learning is essentially a mutual, transactional communication process between teachers and students or between students and other students to attain the defined objective. Transactional communication is acceptable, understandable, and agreeable for parties engaged in a learning process.

Trianto (2013) posits that a learning device is used in a learning process. Daryanto & Aris (2014) propose that a learning device indicates a teacher's preparation prior to a learning process.

A poor learning method a teacher applies will likely adversely affect student learning. A teacher may implement such a poor learning method as a result of a lack of preparation and understanding of the learning material. It can generate student dislikeness toward the lesson or the teacher (Slameto, 2013).

* Corresponding author: Tirtawaty Abdjul

Our observation at SMA Negeri 1 Kabila pointed out very limited learning devices used and the conventional teaching method the teacher used, i.e., lecturing, using PowerPoint media. Additionally, teachers provided no exercise examples or assignments for students. The lecturing method prevented students from making interaction with others and brought about teacher-centered learning. It grew boredom in students.

Students consider physics a complex lesson to understand. They have no full understanding of basic physics concepts and related equations. A wealth of students cannot analyze the confronted issue, especially related to learning materials concerning basic concepts and their relationship with physics analyses.

Teachers needed to find the way of how to engender learning which generates expected results. Teachers can choose effective learning models and approaches and prepare efficient learning devices. A cooperative learning model demands cooperation to realize common purposes. According to Badrun & Hartono (2013), a cooperative learning model offers some steps, embarking upon material explanation delivery, student grouping, assessment, and award giving. This learning model enables student to solve a problem together and practice information delivery.

An inquiry learning approach is based on searching and finding through a systematic and logical thinking process. This approach perceives knowledge as the result of a self-finding process rather than as a fact resulting from recalling. Amri (2013) remarks that an inquiry learning approaches posseses some weaknesses. For instance, this approach is only suitable for those with beyond-average competencies. Children with low competencies thus will find difficulties to participate in inquiry-based learning.

Grounded on the explained background, we perceive the criticality to combine a cooperative learning model with an inquiry learning approach implemented in physics learning devices, i.e., lesson plans, student worksheets, learning materials, and evaluation tools.

2. Method

This study uses a research-and-development method to engender a particular product and test the product's effectiveness (Sugiyono, 2013). The development model used was the 4-D development model developed by Thiagarajan et al. to acquire learning devices effective for escalating student learning outcomes. The learning device development process using the 4-D model was composed of four stages, i.e., define, design, develop, and disseminate (Trianto, 2014).

3. Results

This R&D research used the 4D development model by Thiagarajan. The model comprised define, design, develop, and disseminate stages. This research developed learning devices using a cooperative learning model and an inquiry approach for static fluid materials. The research area was SMA Negeri 1 Kabila, Bone Bolango. This research aimed to generate specific products, namely effective learning devices using a cooperative learning model and an inquiry approach for static fluid materials.

The developed learning devices encompassed a lesson plan, a learning material, a student worksheet, and a learning outcome test. The development research results are as follows:

3.1. Define

Activities required in this stage were performed to determine and define development requirements through a preliminary study and literature review. A preliminary study was undertaken through a discussion with physics teachers to identify fundamental issues they confronted when delivering static fluid materials related to learning design, learning implementation, and student physics learning outcomes. A literature study was carried out by observing documents resulting from KBM supervision, curriculum documents, and documents containing the results of the teacher and school assessments of student physics learning outcomes.

3.2. Design

The second stage, the design stage, aimed to design learning devices using a cooperative learning model with an inquiry approach. Activities conducted in this stage were developing a learning outcome test, selecting the format, and making an initial design of learning devices.

3.3. Develop

In this stage, experts were required to perform validation. Suggestions they gave were used to improve the designed learning devices. Development testing was an activity through which the learning device design was tried out on the real subject targets, namely students, observed by observers (teachers). This tryout test resulted in data on the responses, reactions, or comments of the subject targets (students) and observers. The results would support observers' observation data. The results were used to improve learning devices which were continuously re-tried out until considered effective.

3.4. Expert Validation

The initial designs of the lesson plan, learning material, student worksheet, and learning outcome test (draft 1) were validated by experts. Draft 1 was revised into draft 2 after acquiring the assessment results, suggestions, and recommendations from validators.

3.5. Validator

The validators responsible for evaluating our designed lesson plan, learning material, student worksheet, and learning outcome test developed using a cooperative learning model and an inquiry approach consisted of two lecturers from the Physics Department, Postgraduate Program, Universitas Negeri Gorontalo.

3.6. Expert Validation Results Concerning the Developed Lesson Plan, Learning Material, Student Worksheet, and Student Learning Test

Table 1 indicates the general evaluation results from validators concerning the developed lesson plan, learning material, student worksheet, and learning outcome test and draft 1 of research instruments.

Table 1 Learning Device Evaluation

No.	Learning Device	Evaluation Result
1	Lesson plan	Reliable to use with revision
2	Learning material	Reliable to use with revision
3	Student worksheet	Reliable to use with revision
4	Learning outcome test	Reliable to use with revision

3.7. Lesson Plan

Table 2 presents the evaluation undertaken by two panelists regarding the developed lesson plan.

Table 2 The Mean Scores of the Validation Results of the Developed Lesson Plan

No.	Aspect/Indicator	V1	V2	Mean	Percentage	Category
1	Lesson plan format	3.75	3.75	3.75	93.75	Very Valid
2	Learning objective	3.75	3.75	3.75	93.75	Very Valid
3	Required material	4.00	4.00	4.00	100.00	Very Valid
4	Learning material	4.00	3.67	3.83	95.75	Very Valid
5	Learning activity	4.00	4.00	4.00	100.00	Very Valid
6	Language and writing	4.00	3.75	3.87	96.75	Very Valid
7	Time allocation	4.00	4.00	4.00	100.00	Very Valid

Each evaluation item was measured using a validity index formula by Utomo (2018). The number of panelists/validators was two, and the number of evaluation option scores was four, initiated from 1 (the lowest score) to 4 (the highest score). All items, based on validator 1's evaluation, acquired a mean percentage of 98.28%, whereas based on validator 2's evaluation, they acquired a mean percentage of 96.55% with a "Very Valid" criterion.

The percentages stated that the validated components of lesson plans 1-4 with their 23 items were valid.

3.8. Learning Material

Table 3 suggests the evaluation results from two panelists regarding the developed learning material.

Table 3 The Mean Scores of the Validation Results of the Developed Learning Material

No.	Aspect/Indicator	Mean Score	Percentage	Category
1	Material suitability with KI and KD	4.0	100.0	Very Valid
2	Material suitability with student needs	3.5	87.5	Very Valid
3	Material suitability with learning objectives	4.0	100.0	Very Valid
4	Material completeness	3.5	87.5	Very Valid
5	Material clarity	4.0	100.0	Very Valid
6	Material alignment	4.0	100.0	Very Valid
7	Efficiency in understanding the material	3.5	87.5	Very Valid
8	Referential completeness	4.0	100.0	Very Valid
9	Title suitability with the material	4.0	100.0	Very Valid
10	Material summary completeness	4.0	100.0	Very Valid
11	Exercise completeness	4.0	100.0	Very Valid

3.9. Student Worksheet

Table 4 demonstrates the mean scores of the validation results of the developed student worksheet.

Table 4 The Mean Scores of the Validation Results of the Developed Learning Material

No.	Component/Indicator	V	Conclusion
1	Content reliability	87.5%	Very Valid
2	Constructional reliability	96.87%	Very Valid
3	Language reliability	100%	Very Valid
No.	Component/Indicator	V	Category
1	Content reliability	96.67%	Very Valid
2	Constructional reliability	95.83%	Very Valid
3	Language reliability	97.50%	Very Valid

3.10. Learning Outcome Test

Table 5 The Mean Scores of the Validation Results of the Developed Learning Outcome Test

No.	Component/Indicator	V	Conclusion
1	Content reliability	96.67%	Very Valid
2	Constructional reliability	95.83%	Very Valid
3	Language reliability	97.50%	Very Valid

3.11. Field Test

3.11.1. Limited Test

A limited test was carried out to identify the reliability of static fluid learning devices in the field after expert validation. We selected 15 eleventh graders from the Science 2 class who would acquire learning using the designed and validated learning devices.

3.11.2. Learning Device Effectiveness

Learning device effectiveness using a cooperative learning modelwith an inquiry approach is as follows:

Student Response Questionnaire

Student response questionnaires were distributed to 15 students who had used learning devices using a cooperative learning model with an inquiry approach. This questionnaire distribution was conducted after all learning activities from the first to fourth meetings finished and the learning outcome test was given. The results exhibited that the cooperative learning model with an inquiry approach had a percentage of 98.33%, whereas the designed student worksheet, learning material, and evaluation tool had percentages of 99.33%, 98.52%, and 99.33%, respectively. The results indicated a “Very Effective” criterion.

Student Learning Test

Student learning outcomes were acquired through a learning outcome test. A learning outcome test was executed after all learning processes, from the first to fourth meetings, were completed. The limited test pointed out that 15 students acquired an N-Gain > 0.7 with a “High” category and a learning outcome completeness of 100%.

As figured out through the limited test, the results of observing learning implementedness and student activities presented a “Very Practical” criteria. The results of student response questionnaires showed that our learning devices were “Very Effective”, and student learning outcomes acquired a “High” N-Gain and classically had a 100% completeness. It allowed us to draw a conclusion that the devices were reliable to test on a large group without any revision.

Extended Test

We performed the second stage, which was an extended test on actual classes, i.e., the Science 4 class containing 36 eleventh graders and the Science 5 class containing 36 eleventh graders, after undertaking the limited test without any revision. The observation in the second stage was carried out by two physics teachers from SMA Negeri 1 Kabila. The observation was conducted on the learning process, from initial to final learning activities. This observation focused on teacher competencies in executing learning using a cooperative learning model with an inquiry approach and giving student activities. It was performed in 4-time meetings, as defined in the developed lesson plan.

3.11.3. Learning Device Effectiveness

The effectiveness of the developed learning devices using a cooperative learning model with an inquiry approach could be identified through student response questionnaires and a learning test outcome as follows:

Student Opinion

Table 6 The Mean of the Response Questionnaires Distributed to Eleventh Graders from the Science 4 Class

No.	**Aspect**	**Mean (%)**	
		Yes	No
1	Cooperative learning model with an inquiry approach	95.83	4.17
2	Student worksheet	99.72	0.28
3	Learning material	98.77	1.23
4	Learning outcome test	97.78	2.22

Students were given an opportunity to give their opinions on the learning undertaken at the end of the learning session. They were instructed to respond to the questionnaires we provided. Table 6 presents the responses.

Table 7 The Mean of the Response Questionnaires Distributed to Eleventh Graders from the Science 5 Class

No.	Aspect	Mean (%)	
		Yes	No
1	Cooperative learning model with an inquiry approach	98.83	1.17
2	Student worksheet	96.67	3.33
3	Learning material	94.75	5.25
4	Learning outcome test	94.72	5.28

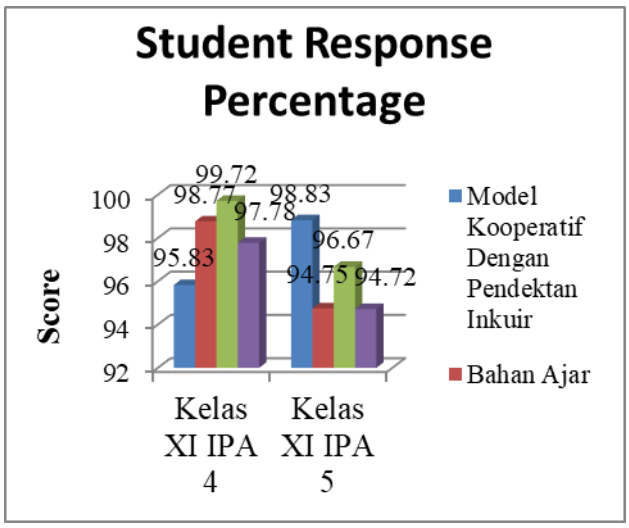

Figure 1 Student Response Percentage

3.12. Learning Outcome Test

The analyses of student initial behaviors and characteristics were carried out by means of exercises given in the initial test and made based on the delivered material, namely static fluid. The initial test results suggested that students from both Science 4 and Science 5 classes did not achieve completeness. The causing factor was that the static fluid material had not been delivered, resulting in students not understanding it. An improvement was noticeable in both classes after the cooperative learning model with an inquiry approach was used.

The results demonstrated that out of 36 eleventh graders from the Science 4 class, 32 (88.89%) attained completeness, while four (11.11%) did not. 34 (94.44%) out of 36 eleventh graders from the Science 5 class achieved completeness, whereas two (5.56%) did not. This student completeness beyond 70% exhibited that the developed learning devices were effective.

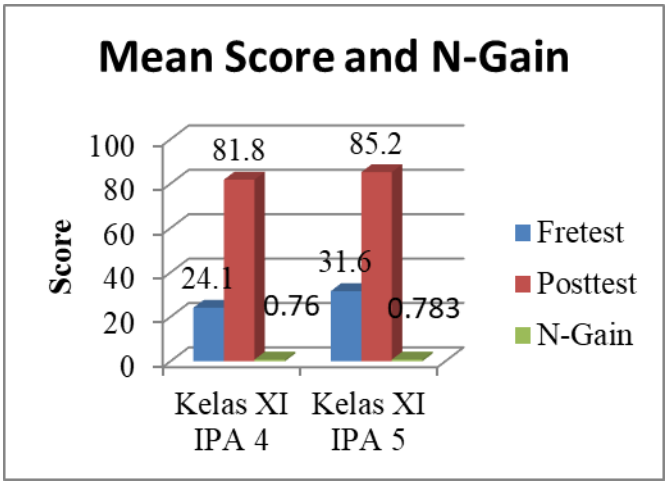

Figure 2 The N-Gain from the Learning Outcome Test

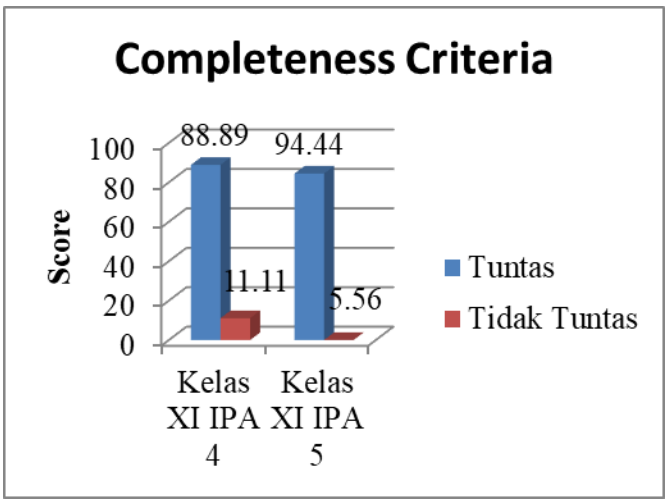

Figure 3 Student Completeness Criteria

3.13. Disseminate

Developing the devices in the stage could not be extended, considering this research focused on merely device development. The disseminating stage was carried out by sole dissemination to physics teachers at SMA Negeri I Kabila and through journals.

4. Discussion

4.1. Validity of the Learning Devices Using a Cooperative Learning Model and an Inquiry Approach for Static Fluid Materials

The validity assessment stage was conducted to validate research instruments, i.e., learning devices (a lesson plan, learning material, student worksheet, and learning outcome test) assessed by experts/validators. The validity assessment was executed through a forum group discussion (FGD) activity by presenting expert validators and supervisors, bringing on suggestion- and recommendation-based revisions crucial to realizing valid learning devices. The FGD activity aimed to improve the initial products and identify the learning devices' reliability. A learning device assessment was undertaken by giving validation sheets to validators after the FGD. The results demonstrated that the learning devices, composed of a lesson plan, learning material, student worksheet, and learning outcome test, were very valid. Validators 1 and 2 gave the following score percentages, respectively: 98.28% and 96.55% for the lesson plan percentage, 97.73% and 95.45% for the learning material, 93.18% and 95.45% for the student worksheet, and 93.18%

and 97.73% for the learning outcome test. The results stated that the devices were reliable to use as they were considered very valid.

4.2. Learning Device Effectiveness

The effectiveness of the developed learning devices was identified through student response questionnaire distribution and a student learning outcome test. The results are as follows:

4.3. Student Response Questionnaire

Student response questionnaires were distributed in the final stage after the implementation of the learning process using a cooperative learning model with an inquiry approach. The questionnaires required students to give answers to questions concerning the learning process using a cooperative learning model with an inquiry approach, learning material, student worksheet, and learning outcome test. All students answered "Yes" to positive questions and "No" to negative questions related to the responded aspects.

The responses of eleventh graders from the Science 4 class were as follows: the cooperative learning model with an inquiry approach was responded with a "Yes" by 95.83% of the students and "No" by 4.17%, the student worksheet aspect was responded with a "Yes" by 99.72% and "No" by 0.28%, the learning material aspect was responded with a "Yes" by 98.77% and "No" by 1.23%, and the evaluation tool aspect was responded with a "Yes" by 97.78% and "No" by 2.22%. Furthermore, the responses of eleventh graders from the Science 5 class were as follows: the cooperative learning model with an inquiry approach was responded with a "Yes" by 95.83% of the students and "No" by 4.17%, the student worksheet aspect was responded with a "Yes" by 96.67% and "No" by 3.33%, the learning material aspect was responded with a "Yes" by 94.75% and "No" by 5.25%, and the evaluation tool aspect was responded with a "Yes" by 94.72% and "No" by 5.28%.

4.4. Learning Outcome Test

A student learning outcome analysis was the key measurement tool. The test developed here was a multiple-choice one with 18 test items. The multiple-choice test was performed in two stages, namely in the pre-test and posttest, each containing 18 test items. The pre-test was given to students prior to learning to identify their initial skills in answering the test items. Learning processes were then given in four meetings. A posttest was then given after all learning processes were completed to identify student learning outcome increases. The pre-test and posttest both contained 18 test items.

The multiple-choice test was analyzed based on the minimum completeness achievement. A certain formula was then used to acquire the percentage of student learning completeness, and student learning outcome increases were measured using an N-Gain. The completeness analysis aimed to identify student completeness percentages from the given multiple-choice test. The learning outcome test result assessment engendered the following minimum completeness results of 36 eleventh graders from the Science 4 class based on the Minimum Completeness Criteria (KKM): 32 students achieved completeness, whereas four others did not. Furthermore, the learning outcome test result assessment engendered the following minimum completeness results of 36 eleventh graders from the Science 5 class based on the Minimum Completeness Criteria (KKM): 34 students achieved completeness, whereas two others did not. The mean percentages acquired by eleventh graders from Science 4 and 5 classes were 88.89% and 94.44%, respectively. The percentages of student learning outcome test completeness were then very good.

Increases in student competencies identified from the learning outcome test were measured using N-Gain interpretation after a treatment using a formula developed by Hake (1998) was given. The N-Gains of the learning outcome test of eleventh graders from the Science 4 class were 24.1% from the pre-test and 81.8% from the posttest, with an N-Gain interpretation of 0.769, therefore categorized as high. Furthermore, the N-Gains of the learning outcome test of eleventh graders from the Science 5 class were 31.6% from the pre-test and 85.2% from the posttest, with an N-Gain interpretation of 0.783, therefore categorized as high.

5. Conclusion

On the grounds of results and discussion, we could draw the following conclusions:

- Developing learning devices using a cooperative learning model with an inquiry approach generated products of a lesson plan, learning material, student worksheet, and learning outcome test. Two validators categorized the learning devices as valid, and each product achieved a percentage ranging from 85.01-100%. A limited test was

performed on 15 students to identify their responses to the learning devices using a cooperative learning model with an inquiry approach and resulted in as follows: 98.33% for the cooperative learning model with an inquiry approach, 98.52% for the learning material, 99.33% for the student worksheet, and 99.33% for the learning outcome test. Overall, the learning devices were effective for learning.

- Learning devices using a cooperative learning model with an inquiry approach for static fluid materials were effective at mean evaluation scores for each component as follows: 95.83% for the cooperative learning model aspect, 99.72% for the student worksheet, 98.77% for the learning material, and 97.78% for the evaluation tool (acquired from eleventh graders from the Science 4 class) and 95.83% for the cooperative learning model aspect, 96.67% for the student worksheet, 94.75% for the learning material, and 94.72% for the evaluation tool (acquired from eleventh graders from the Science 5 class). In terms of the learning outcome test, eleventh graders from the Science 4 and 5 classes had N-gains of 0.760 and 0.783, respectively, and both were categorized as high.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Uno, H. 2014. Profession. Jakarta: PT. Literary Earth.

[2] Sudjana, N. 2013. Research on the Results of the Teaching and Learning Process. Bandung: Rosda Karya Youth.

[3] Trianto. 2013. Designing Innovative, Progressive Learning Models, Concepts, Foundations and Implementation in the Education Unit Level Curriculum (KTSP). Jakarta: Kencana Prenada Media Group.

[4] Daryanto & Dwicahyono, A. 2014. Development of Learning Tools. Yogyakarta: Gava Media.

[5] Hernawan, A. B. 2013. The Influence of Participation in Intra-School Student Organization Activities and Emotional Intelligence on Learning Creativity.

[6] Slameto. 2013. Learning and the Factors that Influence It. Jakarta: Rineka Cipta.

[7] Badrun & Hartono. (2013). The effectiveness of the STAD Model Cooperative Learning Method in terms of Student Achievement and Learning Motivation in Class VIII SMP. Pythagoras: Journal of Mathematics Education, Vol. 8, no. 2, pp. 120-134.

[8] Amri, S. 2013. Development and Learning Models in the 2013 Curriculum. Jakarta: PT. Library Achievements.

[9] Sugiyono. 2013. Quantitative, Qualitative and R&D Research Methods. Bandung: Alphabeta.

[10] Trianto. 2014. Designing Innovative, Progressive and Contextual Learning Models. Jakarta: Prenadamedia Group.