Development of a senior high school on dynamic fluid learning material in the setting of group investigation type of cooperative learning

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Abstract. Pedagogical competence that must be held by teachers is to prepare the learning in the learning material. The development of science and technology requires teachers to develop learning material. However, in the practice of learning in schools there are still issues related to learning material such as conventional methods that the main choice resulted in a lack of student independence. Therefore, we need an alternative development of learning material to apply the model Cooperative Learning Type Group Investigation with the aim is to describe the quality of learning materials dynamic fluid SMA in model setting cooperative learning type group investigation an seen from validity, practicality, and effectiveness. This research uses the ADDIE (analysis, design, development, implementation and evaluation) development model. Subjects tested in this study are students of class XI IPA 2 SMAN 4 Banjarmasin. Instruments used in this research include validation module sheet, implementation lesson plan sheet, and student learning outcomes test. Based on the data analysis, it is found that the validation of learning material developed categorized is very valid, the practicality of learning material developed categorized very well, and the effectiveness of learning material developed in moderate category. Thus a material that is eligible for use in the learning process can be produced.

1. Introduction

In this education world, skills and professionalism of teachers is highly needed. Teachers are expected to have pedagogic competence in the form of ability to plan, implement learning and assess. Teachers must have pedagogic competence in the form of planning and implementing learning, and planning and conducting the assessment [1]. Learning planning can be poured significantly in the learning material, so that with this learning material the learning process can run well and be directed in achieving learning objectives. In addition, the rapid development of science and technology requires educators to develop learning materials in teaching and learning process. However, in the daily practice of learning in schools, there are still many problems related to learning materials such as conventional methods that still become the main choice in the learning process. Daily practice of learning in schools is still experiencing various problems with learning materials that used to operate the course of learning [2].

Based on the results of interviews with physics teachers in SMA Negeri 4 Banjarmasin, it is known that the problem related to learning materials is that there is no a complete learning tool developed.

Learning materials that have been developed are only lesson plan but there is no development teaching materials, student worksheets and assessment in accordance with the models and methods used. In the learning process teachers usually only use the student worksheets from certain publisher in which have already contained teaching materials, experiments and evaluation questions. In addition, conventional learning model still becomes the main choice. Implementation of the current learning model makes students tend to be passive and only wait for information conveyed by the teacher. In other words, they have lack of independence as learners. This lack of independence affects the learning outcomes of learners that is only worth 50.9 which implies that learner have low understanding of physics subjects. According to physics subject teachers in SMA Negeri 4 Banjarmasin, one of the material that is difficult to understand students in SMA Negeri 4 Banjarmasin is dynamic fluid material.

The right solution is needed to overcome this problem. In this research the researcher tries to develop a complete learning material. Starting from the lesson plan, teaching materials, students worksheets and assessment of learning outcomes. By knowing the lack of students' independence in solving the physics problem, the researcher will develop a learning material in the setting of the Group Investigation Type of Cooperative Learning Model. Group Investigation Type of Cooperative Learning Model is a learning model that organizes learners into investigation groups and emphasizes the participation of learners to find their own learning materials through available materials starting from finding problems and solving their own problems, so that the learners' independence can be formed in the learning process. Group Investigation type of Cooperative Learning can train students to foster independent thinking skills [3], and be effective in improving learners' learning outcomes [4].

The learning materials selected in the development of learning material in the setting of the Group Investigation Type of Cooperative Learning Model is the class XI learning. Based on the interview, the material that is the most difficult to understand by the learners is dynamic fluid. Dynamic fluid material is the subject matter of physics that is contained in the material of Class XI in the even semester of Senior High School level with basic competence to analyze laws related to static fluid and dynamic fluid and its application in daily life. In the KTSP syllabus, the learning activity on dynamic fluid material is widely applied to analyze the laws and fluid principles through experiments and demands the students to solve the problem that they are facing, thus it is appropriate to apply Group Investigation type of Cooperative Learning.

Based on the description above, the researcher conducted a research entitled "Development of A Senior High School Dynamic Fluid Learning Material in the Setting of Group Investigation Type of Cooperative Learning". The formulation of the problem in this research is; how is the feasibility of the Senior High School dynamic fluid learning material developed in the setting of Group Investigation type of Cooperative Learning viewed from the aspect of validity, practicality, and effectiveness? While the purpose of this study is to describe the feasibility of the Senior High School dynamic fluid learning material developed in the setting of Group Investigation type of Cooperative Learning viewed from aspects of validity, practicality, and effectiveness.

2. Methods

Learning material developed in cooperative learning model type group investigation in this study include, lesson plan, teaching materials, student worksheet and learning outcome test. According to regulation of education and culture minister number 65 of 2013 on standard process of primary and secondary education, lesson plan is a plan of face-to-face learning activities for one or more meetings [5]. Teaching materials are lesson materials given to learners as a guide to follow the learning process. Student worksheets are sheets containing tasks and steps / instructions in completing the task, both theoretical and practical tasks [1]. The assessment of learning outcomes is a teacher activity in making decisions about the achievement of competence in the learning process [5].

Group Investigation is a form of collaborative learning that emphasizes the participation of group members in finding their own learning materials being studied [3]. Group Investigation is appropriate

for integrated study projects with the mastery, analysis, and synthesis of information in relation to solving learning problems [6].

This research is a development research with ADDIE development model. The ADDIE development model consists of 5 stages: Analysis, Design, Develop, Implement and Evaluate [7]. The subjects of this study were students of class XI IPA 2 of SMAN 4 Banjarmasin. This study was conducted from October 2016 to August 2017. Instruments in this research are the validation sheet of the material, the observation sheet of the implementation of RPP and the test of learning result. The validity of the learning material [2] can be known by using equation 1:

$$V = \frac{Tse}{Tsh} \times 100\% \quad (1)$$

Note:
V = validity
Tse = score of validity result
Tsh = maximum score

The validity of the learning material can be seen in the table 1 on the criteria of validity categorization of learning material [2].

Table 1. Criteria of validity categorization of learning material.

No.	Validity Criteria	Level of Validity
1	85,01% - 100,00%	Highly valid
2	70,01 % - 85,00%	Valid
3	50,01 % - 70,00 %	Moderately Valid
4	01,00 % - 50,00 %	Not valid

Practicality of learning material can be acquire from the implementation of lesson plan [8], a good implementation of lesson plan shows that the teacher can manage the learning based on the learning model procedure [9]. Criteria of the assessment of the implementation of lesson plan can be seen in Table 2:

Table 2. Criteria of the assessment of the implementation of lesson plan.

No.	Interval	Category
1	3,6-4,0	Very Good
2	2,6-3,5	Good
3	1,6-2,5	Moderately Good
4	1,0-1,5	Not Good

The result of the lesson plan implementation analysis can be found from the following equation [10]:

$$P = \frac{\sum A}{\sum N} \times 100\% \quad (2)$$

Note:
P = Percentage of lesson plan implementation
$\sum A$ = Total score of the observed/ implemented aspect
$\sum N$ = Total score of observed aspect

To provide meaning and decision-making the provisions in Table 3 is used [10]:

Table 3. Category of lesson plan implementation.

No.	Criteria	Level of Implementation
1	75%-100%	Perfectly implemented
2	50%-74%	Well implemented
3	25%-49%	Less implemented
4	0%-24%	Not implemented

The effectiveness of learning in term of students learning outcomes test. It is showed by the increase of learning outcomes of learners with the results of gain score.

$$\langle g \rangle = \frac{\%\langle S_f \rangle - \%\langle S_i \rangle}{100\% - \%\langle S_i \rangle} \quad (3)$$

Note:
$\langle g \rangle$ = *Normalized gain (N-gain)*
$\langle S_f \rangle$ = Posttest score
$\langle S_i \rangle$ = Pretest score

High or low of students learning improvement results the *N-gain score* [11] are categorized based on the following table:

Table 4. Category of N-gain result.

N-Gain Score	Category
$\langle g \rangle > 0{,}70$	High
$0{,}30 \leq \langle g \rangle \leq 0{,}70$	Moderate
$\langle g \rangle < 0{,}30$	Low

3. Results and Discussion

Learning material developed in the setting of Group Investigation type of Cooperative Learning on the subject of dynamic fluid in the form of lesson plan, teaching materials, students worksheets, and test of learning outcomes. The following are the learning material product that developed:

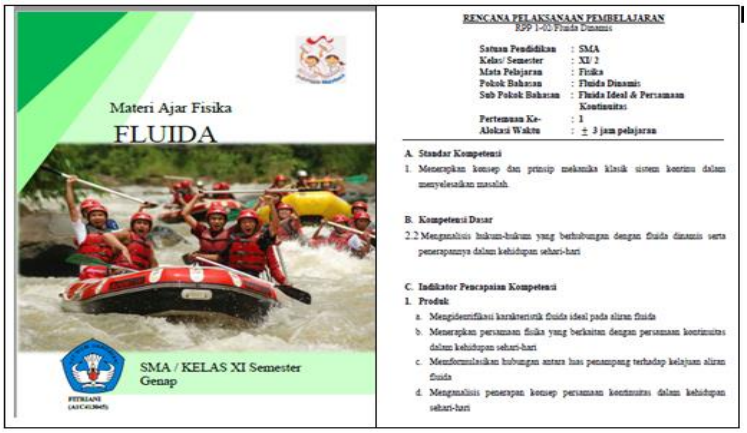

Figure 1. Teaching material and lesson plan

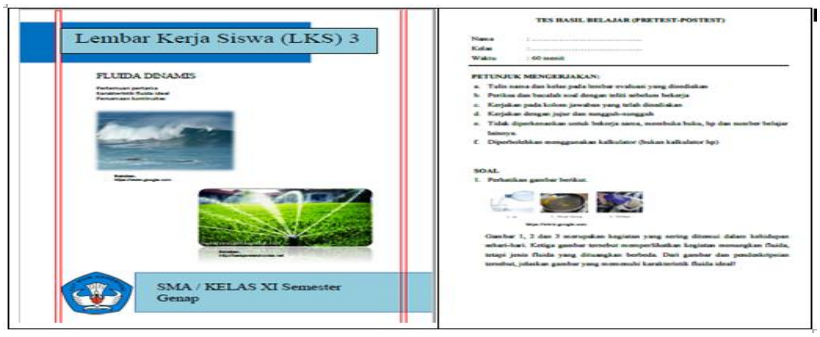

Figure 2. Student worksheet and test of learning outcomes.

As for the results of the feasibility learning material developed from the aspect of validity, practicality, and effectiveness, can be described as follows:

3.1. Validity of learning material

The result of validation analysis of lesson plan implementation can be seen in Table 5:

Table 5. Results of lesson plan validation.

Assessment Aspects	**Total**	**Validity score**		**Mean**
		1	**2**	
Format of Lesson Plan	4	15	13	14
Content	10	38	35	36,5
Language	2	9	9	9
Total	16	62	57	59,5
Mean		3,9	3,6	3,75
Validity	92,97%	Highly valid		

From the table above, it is known that the validity of lesson plan is categorized as highly valid. This indicates that the lesson plan is structured in accordance with the format of lesson plan, the quality of content and language. This is in accordance [12] who stated that a product is said to be valid if it meets the criteria of validity.

The results of validity analysis of dynamic fluid teaching materials can be seen in Table 6:

Table 6. Result of teaching material validation.

Assessment Aspects	**Item**	**Validity score**		**mean**
		1	**2**	
Relevant	7	22	24	23
Accurate	3	9	11	10
Complete	7	28	24	26
Corresponding	3	9	11	10
Presentation	4	13	13	13
Language	4	12	12	12
Total	28	93	95	94
Mean		3,3	3,4	3,35
Validity	83,94%	Valid		

From Table 6, it can be seen that the validity of teaching materials is categorized as valid. The teaching material is developed with group investigation type of cooperative learning model. This indicates that the developed teaching material meets aspects of relevance, accuracy, completeness, conformity, way of presentation and language. The dynamic fluid teaching material developed in the study consists of cover page, introduction, and table of contents, user manual, expected competence, concept map, dynamic fluid material, summary, bibliography and glossary.

The result of validation of students' worksheets can be seen in the table below.

Table 7. Results of validation of students worksheet.

Requirements Assessment	**Item**	**Validity Score**		**Mean**
		1	**2**	
Dictactic	4	15	11	13
Construction	6	21	22	21,5
Technical	3	10	10	10
GI	3	12	11	11,5
Total	16	58	54	56
Mean		3,6	3,4	3,5
Validity	87,50%	Higly valid		

Based on the table above the validation of students worksheet is categorized very valid. This indicates that the students worksheets developed meet the aspects of didactic conditions, terms of construction, technical requirements. This student worksheet with group investigation type of cooperative learning model consists of cover page, learners' data, topic selection, topic 1 and topic 2. Topic 1 and topic 2 each contains the task planning (which contains the formula problems, hypothesis formulation, variable identification and operational definition of variables), investigations (containing experiments, data retrieval, analysis and conclusions) as well as the final project (which contains both the prediction and abstraction strengthening questions).

Result of validation test of learning result test in detail can be seen in Table 8:

Table 8. Result of validation of learning result test.

Aspect	**Item**	**Validity Score**		**Mean**
		1	**2**	
Question Material	3	12	10	11
Construction	3	11	11	11
Language	3	9	10	9.5
Time	1	3	3	3
Total	10	35	34	34.5
Mean		3.5	3.4	34.5
Validity	86.25%	Highly valid		

From the table above, it is known that validation of learning result test is categorized very valid. This indicates that learning result test is developed in accordance with the subject matter, construction, language, and time.

3.2. Practicality of Student Worksheets

The results of analysis of the implementation of Lesson Plan can be seen in Table 9:

Table 9. Analysis of the implementation of the lesson plan.

	Mean of meetings			Mean
	1	2	3	
Total	86	82	83	85,9
Mean	3,91	3,90	3,95	3,90
Percentage(%)	97,7	97,6	98,8	Perfectly Implemented

The practicality of the learning material in this research is viewed from the aspect of the lesson plan [13]. Overall the implementation of lesson plan is categorized perfectly implemented. This indicates that the learning material developed is easy to use, this is demonstrated by very well the implementation of lesson plan that conducted by the teacher.

3.3. Practicality of Student Worksheets

The effectiveness of learning materials developed in this study is known from the results of pretest and posttest of the students [14]. An analysis of the effectiveness of learning material can be seen in Table 10.

Table 10. Results of effectiveness analysis of learning material.

Analysis	Mean	Category
$\langle g \rangle$	0,49	Moderate

From Table 10, it is found that the effectiveness of the learning material is moderate. It also shows that with the existence of this learning material can effectively improve learners' learning outcomes. Learning material is effective if there is increased in learning outcomes of learners [15]. Learning with group investigation type of cooperative learning model is effective in improving learners' learning outcomes [16].

4. Conclusion

Based on result of data analysis, it is found that dynamic fluid learning material in the setting of group investigation type of cooperative learning model is feasible to be used in learning process because the validity of learning material is categorized very valid, practicality of learning material is categorized perfectly implemented, and the effectiveness of learning material is categorized as moderate.

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References

[1] Daryanto and Dwicahyono A 2014 *Pengembangan Perangkat Pembelajaran* (Yogyakarta: Penerbit Gava Media)
[2] Akbar S 2015 *Instrumen Perangkat Pembelajaran* (Bandung: PT Remaja Rosdakarya)
[3] Fathurrohman M 2015 *Model Model Pembelajaran Inovatif* (Jogjakarta: Ar-ruzz Media)
[4] Gusmawati G dan Zainuddin Z 2016 *Berkala Ilmiah Pendidik. Fis.* **1(1)** 126
[5] Kunandar 2014 *Penilaian Autentik* (Jakarta: Rajawali Pers)
[6] Slavin R E 2005 *Cooperative Learning* (Bandung : Penerbit Nusa Media)
[7] Rusjiah M, Arifuddin J M, dan Ichsan M A 2016 *Berkala Ilmiah Pendidik. Fis.* **4 (1)** 13
[8] Habibbulloh M, Jatmiko B, dan Widodo W 2017 *J. Penelit. Fis. Apl.* **7(1)** 27
[9] Ayuningtyas P, Soegimin W W, dan Supardi Z A I 2015 *J. Penelit. Pendidik. Sains* **4 (2)** 636
[10] Mursali, S. 2015. *J. Pendidik. Bio. Indonesia* **1 (3)** 307

[11] Hake R 1998 *Am. J. Phys.* **66 (1)** 64
[12] Palupi E W, Yuwono I, dan Muksar M 2017 *J. Kajian Pembel. Mat.* **1 (1)** 10
[13] Yazid A 2012 *J. Prim. Educ.* **1 (1)** 3
[14] Rusiati, Zainuddin, dan Salam M A 2015 *Berkala Ilmiah Pendidik. Fis.* **3 (3)** 220
[15] Chodijah S, Fauzi A, dan Wulan, R 2012 *J. Penelit. Pembel. Fis.* **1 (1)** 1
[16] Wahyuni D, Fihrin, dan Muslimin 2013 *J. Pendidik. Fis.* **2 (1)** 33