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Development of Student Worksheets Based on React Model to Increase Student Motivation in Newton's Law Materials

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Abstract: The purpose of this study was to determine the feasibility of student worksheets based on the REACT model in increasing motivation on Newton's law material at the Aceh Aviation State Vocational High School. This study uses research and development methods with the ADDIE model. The results obtained are the average value of the validator's assessment shows a value of 87.3% with a very decent category, as well as the results of the gain classification to see an increase in student motivation of 0.61 which is in the medium category. It was concluded that the developed student worksheet based on the REACT model was feasible to use and could increase students' motivation on Newton's law material at the Aceh Aviation State Vocational High School.

Kata kunci: Student Worksheet; REACT Model; Learning Motivation

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Introduction

Learning is a plan that contains a series of activities designed to achieve learning objectives (Prastowo, 2017). Learning is one of the teaching and learning processes that causes interaction between teachers and students. Learning is not only limited to conveying material to students. However, the teacher must also be able to activate these students. Understanding of learning concepts is strongly driven by students' learning motivation, because motivation itself is one of the most important elements in learning. According to Doyan et al (2018), it is stated that learning motivation is influenced by the students themselves. So, students who have high learning motivation will be very helpful in learning something.

Gustina and Sidin (2018) state that students with low learning motivation may learn because they are forced and do not consider learning as a necessity. Motivation is not only important to make a student involved in learning activities, but also in determining how far the student acquires knowledge in a learning activity. According to (Taufiq et al., 2016) learning motivation must be increased because a motivation will produce higher learning achievement as well. In other words, motivation is one of the encouragements of the students in learning a subject matter well. (Nasir et al., 2015) However good the learning design by the teacher will not work optimally if the motivation of students who take part in the learning process is still low. Students need supporting facilities and infrastructure such as learning media. Learning media are everything that can be used to convey the content of teaching materials (Jalinus and Ambiyar, 2016). Learning media is a tool in learning that contains certain learning materials as learning resources. Learning media will make it easier for teachers to deliver subject matter to students effectively and efficiently. By using learning media, it is hoped that the learning objectives will be achieved more optimally. Firdawati et al., (2021) stated that the use of learning media in the teaching and learning process can lead to motivation in supporting the achievement of learning objectives.

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In the 2013 curriculum, there are many learning media that can be used to increase learning motivation, one of which is by using student worksheets. According to Trianto (2009), student worksheets are in the form of a guide for the development of cognitive aspects as well as a guide for the development of all aspects of learning in the form of an experimental or demonstration guide, Nurhidayanti et al., (2017), states that the Student Worksheet can be used to assist students in finding a concept. In other words, the Student Worksheet can be used to facilitate students' understanding of the learning material. According to Ramdani et al., (2019), the Student Worksheet is very useful because it can provide opportunities to improve skills in the 21st century for students. In addition, the results of research from Maghfiroh and AuliaSyafa'ati in 2017, stated that the use of student worksheets can improve student learning outcomes and motivation. From the results of Nasir's research (2015) Student worksheets can improve student learning outcomes and motivation. Several research results show that student worksheets have a positive impact on increasing learning motivation.

Based on the results of observations and interviews at the Aceh Aviation State Vocational High School, the researchers found several problems. First, students need new teaching materials in the form of Student Worksheets. Previously, the teacher had used Student Worksheets. However, the Student Worksheets used had not been able to bring students to be more enthusiastic in learning and doing their assignments in class. Second, students' learning motivation was still low. This can be seen from some students who look passive and less participative when the learning process is in class. The problems mentioned above encourage researchers to develop a new student worksheet so that it can be used by these students in the hope of fostering a spirit of learning and increasing motivation.

Physics lessons are very synonymous with phenomena in everyday life, therefore a suitable learning model is needed to be developed in learning through worksheets, so that later students are more active and motivated in learning. The suitable learning model is the REACT learning model. A student worksheet based on the REACT model will be an appropriate breakthrough if it is developed in a classroom learning, because a student worksheet based on the REACT model is a student worksheet developed by applying the five stages contained in the REACT model. The five REACT stages contained in the Student Worksheet are the Relating, Experiencing, Applying, Cooperating, and Transferring stages. (Ultay, 2012). Based on the results of the description above, the authors conducted a study on the Development of Student Worksheets Based on the REACT Model to Increase Students' Motivation in Newton's Law Materials.

Method

The method used in this research is Research and Development (R&D) (Sugiyono, 2013). R&D is a research method used to develop or validate products used in education and learning. The design used in this study is the ADDIE model (Hadi and Dwijananti, 2015). This model has simplicity and is easy to understand, has a structure that is systematically arranged, so that the steps in the study must be in sequence and should not be random. There are five stages in the ADDIE model, namely: Analyze, Design, Development, Implementation, and Evaluation. The feasibility of a Student Worksheet is done by first assessing the Student Worksheet. The results of the assessment are averaged and then the results are adjusted to the predetermined categories. The instrument used for the feasibility of this Student Worksheet is by using an expert validation assessment questionnaire, both material and media, which is calculated by the percentage of respondents' overall answers using the percentage formula. (Sugiyono, 2009).

$$P = \frac{\sum X}{\sum XI} \times 100\ \% \quad (1)$$

Information:
P = Percentage
$\sum x$ = Number of respondents' answers in one item
$\sum xi$ = The number of ideal values

Then look for the percentage of validation criteria. The validation criteria used can be seen in Table 1.

Table 1. Student Worksheet Assessment Criteria

No	Interval (%)	Kriteria
1	$(80 < P \leq 100)$	Very worth
2	$(60 < P \leq 80)$	worthy
3	$(40 < P \leq 60)$	Decent enough
4	$(20 < P \leq 40)$	Not feasible
5	$(P \leq 20)$	Very unworthy

While the analysis process of increasing students' learning motivation uses a questionnaire, which is a statement related to the REACT model on learning motivation. The scale used in this questionnaire is a Likert scale. The researcher chose the alternative choices of “strongly agree”, “agree”, disagree” and “strongly disagree. Analyzing students' learning motivation on the REACT learning model used the percentage formula according to Sudijono (2013).

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

Information:
P = Percentage number
F = Frequency of students who answer
N = Total number of subjects

The criteria for calculating student motivation responses are as Table 2.

Table 2. Criteria for CalculatingStudentResponses.

No	(%)	Criteria
1	(76-100)	Very high
2	(56-75)	High
3	(40-55)	Medium
4	(0-39)	Low

To find out the significant level of students' learning motivation, the gain test between before and after being given treatment used the gain equation, namely:

$$(g) = \frac{Sf - Si}{Sm - Si} \quad \text{.....} \quad (3)$$

Information:
S_f = Average post-test score of students
S_i = Average pre-test score of students
S_m= Maximum score

The amount of the average Gain states the normalized Gain criteria. The classification can be seen in Table 3.

Table 3. Gain Value Classification

No	Interval	Classification
1	(0.70-1.00)	High
2	(0.30-0.69)	Medium
3	(0.00-0.39)	Low

Results and Discussion

Research in this development has produced a product in the form of a Student Worksheet based on the REACT model with the aim that after developing a Student Worksheet based on the REACT model, it can increase students' motivation.

The method used in this study is the research and development method with the ADDIE development model. The results of the stages of the ADDIE model that have been carried out in this study are as follows.

Analysis Results

The results of the analysis of the observations obtained on the problems that arise in learning physics at the Aceh Aviation State Vocational High School are that students really need teaching materials in the form of new student worksheets. Previously the teacher had used it. However, the student worksheets used have not been able to make students more motivated in learning. In addition, students' learning motivation is still low. Some students look passive and less participative when the learning process in class, they only listen when the teacher explains in front of the class. Students still think that physics is a difficult subject so that learning in class is still not optimal.

Design Results

The steps for preparing product designs from student worksheets based on the REACT model include, namely, adjusting competency standards and basic competencies based on the k13 curriculum. The design of the student worksheets is designed according to the REACT model and the stages of development and the material to be studied is Newton's law material. Using A4 paper type, and the size and type of font used is 12 Times New Roman, with 1.5 spacing. This Student Worksheet consists of a cover, introduction, table of contents, core competencies, indicators, objectives, concept maps, stages of the REACT model and evaluation questions.

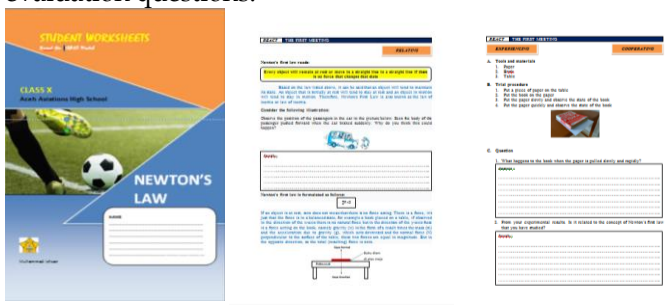

Figure 1. Student Worksheet Design REACT model

Development Results

The process of developing student worksheets based on the REACT model through the design assessment stage by the validator. This process is done by asking for opinions from lecturers and teachers in the field of physics studies. The assessment process is carried out until it is declared suitable for use by students. The student worksheets are first validated according to their domain. The results of the validation by several experts are averaged and then the results are adjusted to the predetermined categories. The results of the validation of student worksheets based on the REACT model are based on two domains, namely validation of material and media experts.

Expert validation Result of material

Eligibility criteria are obtained from the percentage results. The percentage of validation of each aspect in the validation of this material is obtained from the number of respondents' answers to each aspect divided by the number of ideal values per aspect

multiplied by 100%. The average percentage is obtained from the total percentage of all aspects divided by the number of aspects. So that the interpretation criteria that have been determined are obtained. The assessment of the material expert validator before the revision is presented in Table 4.

Table 4. Recapitulation of Material Expert Validation Results before Revision

Aspect	(∑x)	(∑x1)	(%)	Criteria
Content Quality	56.0	90.0	62.2	worthy
Presentation	30.0	50.0	60.0	Decentenough
Language	48.0	80.0	60.0	Decent enough
*REACT*Model	43.0	70.0	61.4	worthy
Total	177	290		
Average			60.9	worthy

After the revision process was carried out, the recapitulation of the validation results from the material experts was carried out again to see the comparison between before and after the improvement of the Student Worksheet. The following are the results of the material validator's assessment after being revised as Table 5.

Table 5. Recapitulation of Material Expert Validation Result after Revision

Aspect	(∑x)	(∑x1)	(%)	Criteria
Content Quality	73.0	90.0	81.1	Very worth
Presentation	41.0	50.0	82.0	Very worth
Language	64.0	80.0	80,0	Very worth
REACT Model	58.0	70.0	82.8	Very worth
Total	236	290		
Average			81.4	Very worth

Expert Validation Results of Media

The assessment on media expert validation is almost the same as the assessment on material experts. The average percentage is obtained from the total percentage of all aspects divided by the number of aspects. So that the interpretation criteria that have been determined are obtained. After that, it is adjusted to the assessment and determination of interpretation criteria on media expert validation. The assessment of the media expert validators before the revision can be seen in Table 6.

Table 6. Recapitulation of Media Expert Validation Results before Revision

Aspect	(∑x)	(∑x1)	(%)	Criteria
Physical criteria	27.0	50.0	54.0	Decent enough
Display	27.0	50.0	54.0	Decent enough
Use of letters	15.0	30.0	50.0	Decent enough
Consistency	52.0	90.0	57.7	Decent enough
Total	121	220		
Average			53.9	Decent enough

After revisions are made according to suggestions from the validator, the assessment is carried out again. The following are the results of the media validator's assessment after the revision is shown in Table 7.

Table 7. Recapitulation of Media Expert Validation Results after Revision

Aspect	(∑x)	(∑x1)	(%)	Criteria
Physical criteria	43.0	50.0	86.0	Very worth
Display	48.0	50.0	96.0	Very worth
Use of letters	29.0	30.0	96.6	Very worth
Consistency	88.0	90.0	97.7	Very worth
Total	208	220		
Average			94.0	Very worth

The overall average calculation of material and media expert validation is shown in Table 8.

Table 8. Average Student Worksheet Eligibility Assessment

No	Aspect	(%)	Criteria
1	Material	81.4	Very worth
2	Media	94.0	Very worth
Average		87.7	Very worth

From Table 8 it can be seen that after calculating the overall average of the validation of material experts and media experts, the average validation result is 87.7%. When viewed from the feasibility classification, the average validation of these two domains has a very feasible category.

Questionnaire Trial Results

The trial was carried out in two stages, namely the first stage of small group trials and the second stage of large-scale trials. After the small group trial is carried out, later on any shortcomings obtained from the results of the attractiveness questionnaire obtained from the students will be corrected again until the Student Worksheet is considered good and more interesting. After that, it can be tested again on a larger scale. This small group trial was taken with a sample of 5 students and in the large-scale test a sample of 30 students in class X at the Aceh Aviation State Vocational High School was taken.

Small group trial

Small group trials were conducted by explaining about the Student Worksheet that was developed. After finishing explaining the product, respondents were given a questionnaire to assess the attractiveness of the product. Furthermore, students are asked to provide an assessment by filling out the questionnaire. The results of student responses to student worksheets based on the REACT model can be seen in Table 9.

Table 9. Trial Small Group of Students

No	Aspect	Persentage (%)
1	Interest	86.0
2	Material	86.0
3	Language	86.6
4	*REACT*	88.0
5	Average Persentage	86.6
6	Interpretation Criteria	Very interesting

Large-scale trial

After doing a small group trial, then the product is tested on a larger scale. This large-scale trial was carried out to ensure data and to find out the wider product appeal. Respondents in this field test amounted to 30 students in class X at the Aceh Aviation State Vocational High School, the results of large-scale trials can be seen in Table 10.

Table 10. Results of Large-Scale Trials of Students

No	Aspect	Persentage (%)
1	Interest	82.5
2	Material	84.2
3	Language	88.8
4	*REACT*	84.4
5	Average Persentage	85.0
6	Interpretation Criteria	Very interesting

Evaluation

Students were distributed motivation questionnaires by pre-test and post-test, with the aim of knowing whether there was an increase in student motivation. Table 11.was the result of the students' motivation questionnaire on the REACT model-based Student Worksheet that they have been used.

Tabel 11. Distribution of Students' Motivation Scores before Using the Student Worksheet

No	Score	Frequ-ency	(%)	Sum	Categories
1	0-39	5.0	16.6	191.3	low
2	40-55	21	70.0	988.1	Medium
3	56-75	4.0	13.4	235.0	High
4	76-100	0.0	0.0		Very High
Total		30	100	1414.4	
Average				47.1	Medium

The results of the analysis of student motivation after using the Student Worksheet based on the REACT model can be seen in Table 12.

Table 12. Distribution of students' motivation scores after using the Student Worksheet

No	Score	Frequency	(%)	Sum	Categories
1	0-39	0.0	0.0	-	Low
2	40-55	0.0	0.0	-	Medium
3	56-75	10.0	33.4	750	High
4	76-100	20.0	66.6	1646.3	Very High
Total		30	100	2396.3	
Average				79.8	Very High

Table 12 shows that the average percentage of students' motivation scores before using the REACT model-based Student Worksheet is 47.1%, meaning that the students' motivation before using the REACT model-based Student Worksheet is in the medium category. This is different after using the Student Worksheet based on the REACT model, which shows that the average percentage score of students' motivations, after using the Student Worksheet based on the REACT model, is 79.8% which is in the very high category as shown in Figure 2.

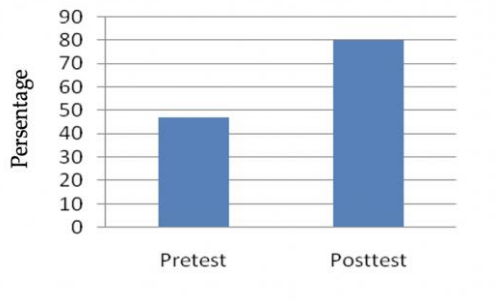

Figure 2. Percentage of pre-test and post-test motivation of students

Based on the students' motivation scores before and after using the Student Worksheet based on the REACT model, the normalized gain classification is obtained as shown in Table 13.

Table 13. Classification of Normalized Gain on student Motivation

Interval	Sum	(%)	Classification
0.70-1.00	3.0	10.0	High
0.30-0.69	27.0	90.0	Medium
0.00-0.39	0.0	0.0	Low
Average	0.6	100.0	Medium

In Table 13 it can be seen that the average normalized gain of motivation is at a score of 0.61 where the score is in the medium category. It can be concluded that there is an increase in the motivation of students with the average being in the medium category.

Conclusion

The Student Worksheet based on the developed REACT model is feasible to use. This can be seen from the average validator assessment of 87.3% with a very decent category. In addition, there is also an increase in students' motivation after using the REACT model-based worksheet on Newton's law material, in terms of the average value of the gain classification, which is 0.61 with medium category.

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