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Direct Current Electric Teaching Materials Through Google Classroom for 16-17 Years Old Students: Teacher Perception

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Abstract

The research aims to produce direct current electricity teaching materials and their application through Google Classroom for students in vocational high schools. This research uses 4-D model development (Define, Design, Develop, and Disseminate). The resulting teaching materials were analyzed for their validity and practicality. This product was distributed to 50 physics teachers. The data were obtained through a validation sheet of teaching materials and a teacher's perception questionnaire on the practicality of teaching materials. The results showed that: (1) the teaching materials developed were valid because the validity of the lesson plans, worksheets, assessments, and teaching materials was in the valid category; and (2) practicality seen from the results of teachers' perceptions of lesson plans in the practical category, and the results of teachers' perceptions of worksheets, assessments, and teaching materials in the very practical category. So it can be concluded that the development of direct current electricity teaching materials using the Google Classroom application is valid and practical for use in learning physics.

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INTRODUCTION

Rapid information technology in the 21st-century changes education and the educational process (Bhat et al., 2018; Dewantara et al., 2020; Hartini et al., 2017; M Misbah et al., 2018). Teacher reactivity in the learning process is necessary to facilitate the quality of learning (Suyidno et al., 2019). A teacher needs to develop the teaching materials based on curriculum requirements and target characteristics to achieve learning objectives (Herawati, 2015).

The development of teaching materials must also be adapted to today's technological advances. The advancement of technology provides convenience in obtaining all the necessary information. This phenomenon demands the internet to be faster (Apriansyah & Pujiastuti, 2020). Internet functions as a learning medium (Herayanti, L Fuaddunnazmi & Habibi, 2017). The internet can be used as a learning medium is possible by providing online learning tools (Apriansyah & Pujiastuti, 2020). Learning media that utilize computers or smartphones will be more exciting and interactive for students (Alim et al., 2019; Azhar, 2013; Zainuddin et al., 2019). Darmawan (2019) states that mobile phone eases students to understand the content of the reading text. The emergence of learning media affects the learning process because if the teaching materials are attractive, then the motivation will be more robust (Kuswanto & Walusfa, 2017).

Google Classroom is one platform that can be used to simplify the online learning process (Perrotta et al., 2021). Google Classroom can be used through a computer or smartphone based on user needs (Gunawan & Sunarman, 2018). Google Classroom is part of a Google Apps for Education

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(GAFE) product that integrates with several other services, such as Google Mail, Google Calendar, Google Drive, and Google Docs (Pradana, 2017). Compared to other apps, the advantage of the Google Classroom app is that it has been specifically designed to help teachers learn. Through the Google Classroom, learning objectives can be achieved quickly and meaningfully (Sabran & Sabara, 2019). Therefore, Google Classroom makes it easier for teachers to manage and convey information accurately and accurately to students (Hakim, 2015).

Research conducted by Nugraha (Nugraha et al., 2017) on the development of physics teaching materials obtained a feasibility value of 82.7%. Also, Gunawan & Sunarman (2018) show that Google Classroom is 88% operational and run well. Students who believe in learning using online media are 23.3% (Mustakim, 2020). Online learning activities have increased during COVID-19. The increase is seen from the learning cycle, namely cycle I, which obtained an average value of 56.25% and cycle II, 73.9% (Nurhayati, 2020).

Based on existing research on the advantages of Google Classroom, no one has done the development of teaching materials on electrical materials at the vocational high school level. Therefore, this research was conducted to produce direct current electric teaching materials using the Google Classroom application for the tenth grade of vocational school students.

METHOD

This research is Research and Development with a 4-D model (Define, Design, Develop, and Disseminate). The developed product was a direct current electric teaching material using the Google Classroom application for the tenth-grade students of Vocational school. Table 1 shows the stages of the 4-D model.

Table 1. The Stages of 4-D Model Development

Step	Activity	Result
Define	Curriculum analysis	The revised 2013 curriculum prioritizes the activeness of learners, the achievement of students' personal and classical abilities, and the use of approaches and methods of delivery of learning.
	Student analysis	Students tend to be interested in learning styles that use the internet. For example, students are interested in learning physics if the learning does not make them feel bored.
	Material analysis	This teaching material discusses the direct current electricity. Several sub-subjects are to be studied dynamic electricity, Kirchhoff's law, and present direct energy and electric power.
	Formulation of learning objectives	The purpose of learning refers to the standard of physics content in the revised 2013 curriculum and is based on the essential competencies to be achieved on direct current electrical material.
Design	Media selection	The developed learning media was direct current electric teaching materials using the Google Classroom application. The development of teaching materials has been adapted to the characteristics of learners, essential competencies, indicators of competency achievement, and learning objectives for the revised 2013 curriculum.
	Format selection	The main format of the discussion in teaching materials is the lesson plan, student worksheet, learning outcome test, and teaching materials related to direct current electrical materials.
Develop	Expert validation	Analyze the results of expert validation to determine

Step	Activity	Result
		the validity of the teaching materials developed.
	Simulation	Simulation is carried out to operationalize the lesson plan and request peer responses to the teaching materials developed.
Disseminate	Dissemination of teaching materials	The dissemination of teaching materials is done by distributing questionnaires to 50 high school and vocational school physics teachers in South Kalimantan and Central Kalimantan.
	Scientific publications	Scientific publications aim to make the product more widely usable by others. Therefore, the stage of deployment is planned for publication in scientific journals.

The subject of this study was direct current electric teaching materials using the Google Classroom application that was distributed to 50 high school and vocational school physics teachers in South Kalimantan and Central Kalimantan. The research objects were the validity and practicality of direct current electric teaching materials using the Google Classroom. The research instrument was a validity instrument that reviewed the aspects of format, language, content, presentation, and benefits/uses by three validators. Table 2 shows the assessment criteria for each element of the validity.

Table 2. Assessment Criteria for Each Aspect of Validity

No.	Average Score	Category
1.	X > 3.4	Very Valid
2.	2.8 < X ≤ 3.4	Valid
3.	2.2 < X ≤ 2.8	Relatively Valid
4.	1.6 < X ≤ 2.2	Less Valid
5.	X ≤ 1.6	Invalid

(Widoyoko, 2019)

The formula used to determine the reliability in eq. 1 and the reliability criteria can be seen in table 3.

$$\text{Reliability} = \left(\frac{k}{(k-1)}\right)\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right) \qquad (1)$$

Description:

K: Items' rating

$\sum \sigma_i^2$: Number of variances

σ_t^2: Total variance

Table 3. Reliability Assessment Criteria

No.	Reliability Coefficient (r)	Category
1.	0.80 ≤ r ≤ 1.00	Very High
2.	0.60 ≤ r < 0.80	High
3.	0.40 ≤ r < 0.60	Moderate
4.	0.20 ≤ r < 0.40	Low
5.	0.00 ≤ r < 0.20	Poor

The practicality data of teaching materials is obtained from the perception of 50 teachers toward the teaching materials. Table 4 shows the criteria for teacher perception.

Table 4. The Criteria for Teachers' Perception

No.	Interval	Category

1.	X > 3.4	Very Practical
2.	2.8 < X ≤ 3.4	Practical
3.	2.2 < X ≤ 2.8	Quite Practical
4.	1.6 < X ≤ 2.2	Less Practical
5.	X ≤ 1.6	Impractical

(Widoyoko, 2019)

RESULTS AND DISCUSSION

This research resulted in a direct current electric teaching material assisted by Google Classroom. The teaching materials consisted of lesson plans, student worksheets, evaluation, and teaching materials. The developed product can be seen in the following figures.

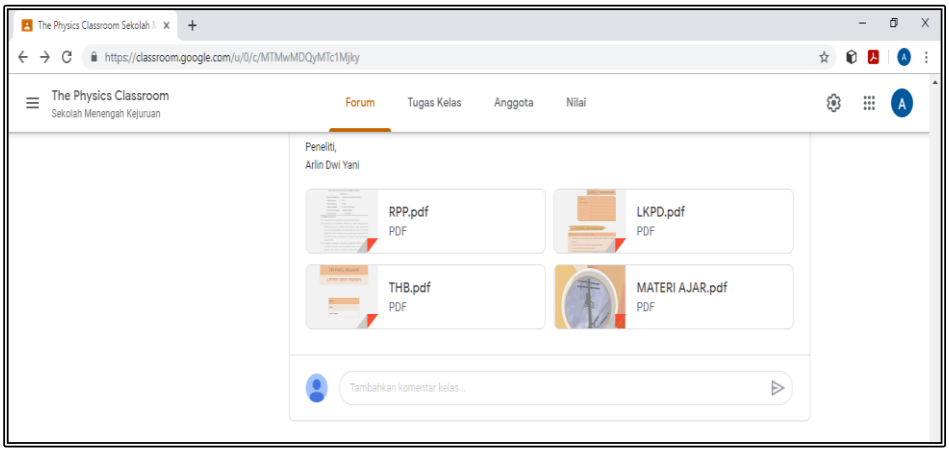

Figure 1. The Teaching Materials

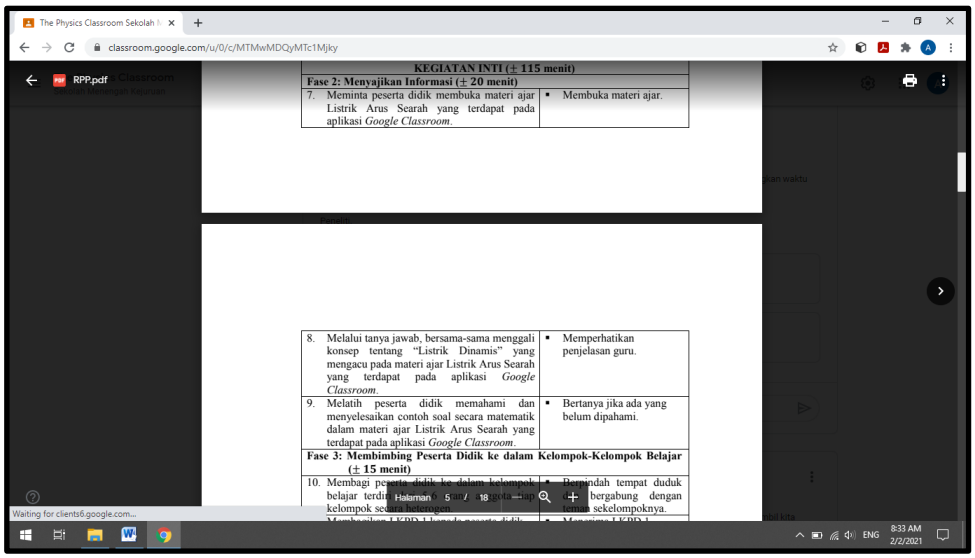

Figure 2. Lesson Plans

Figure 3. The Student Worksheet

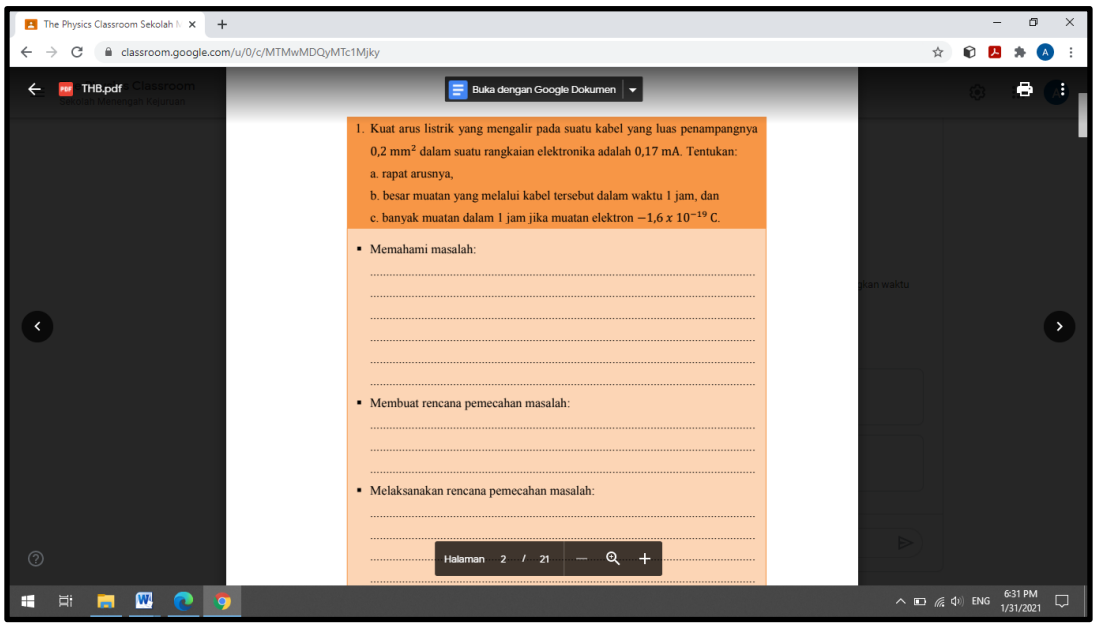

Figure 4. The Learning Outcome Test

Figure 5. The Teaching Materials

The lesson plan is a short-term plan to estimate the actions that will be carried out in learning activities by organizing learning components, namely the identity of subjects, basic competencies, indicators of competency achievement, time, learning objectives, teaching materials, learning steps, learning methods, teaching tools and resources, and assessment of learning outcomes (Indaryanti, 2019). The lesson plan developed includes three meetings with a meeting time of 3 x 45 minutes each. The lesson plan developed is designed with learning activities containing preliminary, core, and closing stages by following the syntax of the cooperative learning model type STAD, which is systematically organized. For example, the lesson plan at the first meeting discussed the dynamic electricity sub-subject, at the second meeting discussed Kirchhoff's law sub-subject, and at the third meeting discussed the sub-subject of power and direct current electric energy.

The student worksheet developed has been adjusted to the lesson plan. The student worksheet developed accommodates activities for three meetings. The student worksheet contains experiments using PhET simulations and questions from sub-materials. The experiments on the student worksheet are tailored to the sub-subjects at each meeting. Student worksheet 1 contains the ohm Law procedure with three prediction questions related to dynamic electrical sub-subject. Student worksheet 2 contains the Kirchhoff Law procedure with three prediction questions related to the Kirchhoff sub-subject. Student worksheet 3 includes a power and electrical energy test procedure with three prediction questions associated with the sub-subject of power and direct current electrical energy.

The learning outcome test refers to the basic competencies to be achieved, described into indicators of achievement of learning outcomes and compiled based on a grid of writing questions complete with the key answers (Ariendhany et al., 2016). The learning outcome test developed in an essay consisting of 6 questions about direct current electricity representing each indicator of competency achievement. Direct current electric teaching materials are developed into three meetings according to the meeting in a lesson plan. The use of teaching materials is also adapted to the activities carried out on the lesson plan.

Validity

Validation is the process of assessing product design by providing an assessment based on rational thinking (Alfianika, 2018). Validation is conducted to evaluate and improve the results of the development of teaching materials developed (Ferdianto & Setiyani, 2018). Assessment of the validity of teaching materials is reviewed through several aspects of assessment. Validation lesson plan and student worksheet include aspects of format, language, and content. Validation, The learning outcome test covers aspects of general construction and language. Furthermore, validation of teaching materials includes aspects of the format of the teaching material, language, content of the teaching material, presentation, and the benefits/uses of the teaching material. The following Table 5 shows the results of the validity of the lesson plan.

Table 5. The Lesson Plan Validity Results

No.	Aspect	Average Score	Category
1.	Format	3.40	Very Valid
2.	Language	3.17	Valid
3.	Content	3.24	Valid
	Validity	3.28	Valid
	Reliability	0.94	Very High

The results of the validator assessment in Table 5 show that lesson plan validity assessments are categorized as valid with a very high degree of reliability. Furthermore, Table 6 shows the results of the student worksheet validity.

Table 6. The Student Worksheet of Validity Results

No.	Aspect	Average Score	Category
1.	Format	3.33	Valid
2.	Language	3.17	Valid
3.	Content	3.17	Valid
	Validity	3.23	Valid
	Reliability	0.83	Very High

Table 6 shows that the student worksheet is categorized as valid with a very high degree of reliability. Table 7 shows the results of the learning outcome test validity.

Table 7. The Validity of Learning Outcome Test

No.	Aspect	Average Score	Category
1.	General Construction	3.21	Valid
2.	Language	3.36	Valid
	Validity	3.25	Valid
	Reliability	0.93	Very High

Table 7 shows that the learning outcome test validity assessment is categorized as valid with a very high degree of reliability. Furthermore, Table 8 shows the results of the validity of the teaching materials.

Table 8. Results of Validity of Teaching Materials

No.	Aspect	Average Score	Category
1.	Format	3.40	Very valid
2.	Language	3.22	Valid
3.	Content	2.94	Valid
4.	Display	3.00	Valid
5.	Benefits/Uses	3.17	Valid
	Validity	3.18	Valid
	Reliability	0.88	Very High

Table 8 shows that the validity of the teaching material is categorized as valid with a very high degree of reliability. The lesson plan developed is following the components contained in Permendikbud No. 22 of 2016, which is composed of school identity; the identity of the subject; class/semester; subject matter; time allocation; learning objectives; basic competencies and competency achievement indicators; learning materials; learning methods; learning media; learning resources; learning steps through the preliminary, core, and concluding stages; assessment of learning outcomes. The lesson plan developed is declared valid, indicating that the lesson plan that has been created has been adapted to the language, format, and content aspects.

Writing the student worksheet generally follows the structure of the student worksheet, which contains the title of activities following basic competence, learning objectives, tools and materials, working procedures, data tables, and discussion materials to conduct data analysis (Kuswari, 2020; Misbah et al., 2018). The student worksheet developed has been adapted to aspects of language, format and content, so that the student worksheet is declared valid.

The preparation of the learning outcome test has followed the basics of drafting the learning outcome test in terms of construction and language. Developed the learning outcome test can measure ability by the teaching objectives contained in the applicable curriculum (Rosarina et al., 2016).

Following the content contained in Permendikbud 2016, the teaching materials have met the requirements of suitable teaching material components. Komalasari (2011) said that the teaching

materials used for learning activities should support the achievement of basic competencies listed in the curriculum. The results of the development of this teaching material can be used as a learning resource for students. Valid teaching materials can be used in classroom learning as a learning resource for learners (Izzati & Kuswanto, 2019; Suniasih, 2019).

The product has a very high level of reliability based on the assessment of the three validators. Therefore, it can be said that the teaching material is reliable and valid for physics learning.

Practicality

Assessment of the practicality of teaching materials is by looking at the teacher's perception of teaching materials. The teacher perception questionnaires were distributed to 50 high school and vocational physics teachers in South Kalimantan and Central Kalimantan. Table 9 shows the results of teachers' perception of the practicality of RPP.

Table 9. Teachers' Perception toward the Lesson Plan

No.	Aspect	Average Score	Category
1.	Component	3.45	Very Practical
2.	Content Compatibility	3.35	Practical
3.	Accuracy	3.14	Practical
4.	Language	3.44	Very Practical
	Practicality	3.35	Practical
	Reliability	0.81	Very High

Table 9 shows that the practicality of the lesson plan is in a very practical category with a very high degree of reliability. Table 10 below shows the results of teacher perception toward the practicality of the student worksheet.

Table 10. Teachers' Perception toward the Student Worksheet

No.	Aspect	Average Score	category
1.	Ease of Use	3.50	Very Practical
2.	The Attractiveness of The Dish	3.36	Practical
3.	Benefit	3.57	Very Practical
4.	Language	3.44	Very Practical
	Practicality	3.45	Very Practical
	Reliability	0.81	Very High

Table 10 shows that the student worksheet is categorized as very practical with a very high degree of reliability. Table 11 shows the results of teachers' perception toward the practicality of the learning outcome test.

Table 11. Teacher's Perception toward the Learning Outcome Test

No.	Aspect	Average Score	Category
1.	Component	3.39	Practical
2.	Content Compatibility	3.47	Very Practical
3.	Accuracy	3.10	Practical
4.	Language	3.42	Very Practical
	Practicality	3.41	Very Practical
	Reliability	0.79	High

Table 11 shows that the learning outcome tests are very practical with high reliability. Table 12 shows the results of teachers' perception of the teaching materials.

Table 12. Teachers' Perception toward the Teaching Materials

No.	Aspect	Average Score	Category
1.	Component	3.46	Very Practical
2.	Content Compatibility	3.30	Practical
3.	Accuracy	3.52	Very Practical
	Practicality	3.43	Very Practical
	Reliability	0.80	Very High

Table 12 show that the teaching materials are very practical with a very high degree of reliability. In general, the practicality of teaching materials has been developed based on perceptions from 50 physics teachers. The product is practical so that students and teachers can easily use it in physics learning activities.

Practical teaching materials are easy to use (Alwi et al., 2020). Students easily accept Google Classroom in terms of usage, display (Alim et al., 2019; Iftakhar, 2016; Mohd Shaharanee et al., 2016; Permata & Bhakti, 2020). Easy-to-use and accessible Google Classroom makes it easy for teachers to manage online learning (Albashtawi & Al Bataineh, 2020; Sulisworo et al., 2016).

Google Classroom is effective for students' mathematical reasoning skills (Santosa et al., 2020), student problem-solving skills (Maharani & Kartini, 2019), students' creative thinking skills (Jumadi et al., 2021), and can train positive attitudes and discipline (Santosa et al., 2020; Zarraonandia et al., 2019). Google Classroom makes students perform better in the learning process (Madhavi et al., 2018). Google Classroom engages students to be active, communicative, imaginative, creative, and collaborative (Ramadhani et al., 2019). Google Classroom is an effective tool for online teaching and learning because of its ease of use and student-friendly and teacher-friendly features (Sheelavant, 2020). Besides, Google Classroom contributes to the quality of learning (Abuzant et al., 2021).

This research has produced valid and practical teaching materials, although this teaching material has not been implemented in the learning process. The developed teaching materials have not been used directly by the students. Therefore, the students' responses toward the teaching materials are not yet known. Similarly, the effectiveness of this teaching material is not yet known.

CONCLUSION

A valid and practical direct current electric teaching material has been produced using the Google Classroom for the tenth-grade students of vocational school. This conclusion is supported by the research findings that the direct current electric teaching materials assisted by Google Classroom were valid. The lesson plan obtained an average validity score of 3.28 (valid). The student worksheet obtained an average validity score of 3.23 (valid). The learning outcome test obtained an average validity score of 3.25 (valid). The teaching Materials obtained an average validity score of 3.18 (valid). The developed teaching materials were practical based on the results of the teacher perception questionnaire. The practicality of the lesson plan obtained an average score of 3.35 (practical). The student practicality of the worksheet obtained an average score of 3.45 (very practical). The practicality of the learning outcome test obtained an average score of 3.41. the practicality of the teaching Materials obtained an average score of 3.43 (very practical).

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