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Drone E-Job Sheet Development: Geospatial Engineering Remote Sensing Subject

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ABSTRACT

This research aims to produce an E-Job Sheet Drone Product for the Class XI Geospatial Engineering Remote Sensing Subject by carrying out feasibility tests, practicality tests, and product effectiveness tests. The research and development methodology uses the 4D development model (four-D models), namely definition, design, development, and dissemination, so that the development design is developed. This research was carried out at SMK Negeri 1 Percut Sei Tuan in class XI Geomatics Engineering in the Remote Sensing (Inderaja) subject. The research results show: (1) E-Jobsheet Drone, suitable for use in remote sensing learning for class XI at SMK Negeri 1 Percut Sei Tuan; (2) Drone E-Jobsheets have proven effective in improving student learning outcomes for class XI at SMK Negeri 1 Percut Sei Tuan compared to conventional learning methods. The application of learning media in the form of E-Jobsheet Drones requires students who are ready to learn independently so that they can achieve optimal learning outcomes by utilizing this media effectively.

KEYWORDS

E-Job Sheet; drones; remote sensing; Geospatial Engineering

INTRODUCTION

Current developments in science and technology impact the way that vocational high schools (SMK) teach and learn. The learning process is further enhanced by the utilization of scientific and technological learning tools and media. in vocational schools, thereby facilitating an effective learning process.

SMK Negeri 1 Percut Sei Tuan is one of the vocational high schools that keeps trying to turn out graduates who can handle the rigors of the working world and industry. SMK Negeri 1 Percut Sei Tuan is a formal educational institution that has several skill programs, one of which is the Geospatial Engineering Skills Program, which has expertise, namely Geomatics Engineering (TGM), where this skills program carries out learning activities covering various engineering subjects. Among the topics that are crucial to the Geomatics Engineering skills program is the Remote Sensing Subject, because it is the basis that supports the Geomatics Engineering subject.

Other productive lessons include Geographic Information Systems (GIS), Terrestrial Survey, Drawing with Software, and others. However, in its development, the department continues to strive to improve the competence of its graduates by developing more effective and efficient learning tools.

In the learning process, instructional materials are needed that can raise student interest, motivation, and knowledge of learning activities. The fundamental aspect that a teacher often faces in learning activities is always the matter of determining the right teaching materials in order to help students achieve the expected competencies. For the subject that will be covered during the learning process, the teaching materials—such as job sheets—

can be modified to meet the needs of the students. When work sheets are used in the classroom, they can motivate students to analyze the subject on their own or in groups with friends through conversation. Job sheets can also give pupils the opportunity to demonstrate their aptitude for using reasoning, guesswork, and searching to develop their thought processes.

In remote sensing learning, teachers apply a scientific approach by combining the syntax of paradigms of project-based learning, problem-based learning, and discovery learning. In short, at each learning meeting, students will be given introductory material first in class, and then learning will continue in the field, namely by direct practice using remote sensing equipment in the field and under the guidance of the subject teacher. Learning in the field (practice) requires students to apply the material they learn in class. Teachers, as field guides, provide guidance in the field and mostly supervise from a distance. The rest of the time, students do practical assignments by sticking to practical worksheets and the knowledge they have. However, what happens in the field is that students, for various reasons, are less interested in reading these materials and often make mistakes when practicing in the field. In fact, when planning field assignments for remote sensing subjects, proper knowledge is needed so that practice does not make mistakes and result in field errors. This is proven through daily tests related to remote sensing material carried out by subject teachers. The daily test results indicate that the average class score in the Remote Sensing subject in class

According to Lillesand and Kiefer (1994), the science or art of remote sensing is the process of gathering data using instruments without coming into close touch with the thing, region, or symptom being examined in order to analyze it and learn more about it. Moreover, Avery (1985) defined remote sensing as an endeavor to locate, identify, and examine items using sensors at the study area's observation position. Furthermore, according to Lindgren (1985), remote sensing is a method created to gather and examine data about the planet. Electromagnetic radiation reflected or emitted from the surface of the earth contains this information.

Thus far, there has been insufficient success in implementing remote sensing education in educational institutions (Ruhyati & Eva, 2019). Teachers' lack of understanding of the material pertaining to the implementation or application of remote sensing concepts, their inability to operate remote sensing software, their continued use of lecture and assignment methods, and their use of incomplete learning materials are just a few of the limitations that drive this.

Arsyad (2014: 4) states The media is referred to as learning media if it conveys messages or information with the intention of instructing or teaching. According to Miarso (2004) learning media is anything that may be utilized to transmit messages that can arouse emotions, ideas, attention, and a desire to learn in order to promote a purposeful, intentional, and regulated learning process.

Basically, learning media is a vehicle for conveying messages or information from the message source that is passed on to the recipient; the message conveyed is learning material to fulfill the established learning objectives, so that in the process, media is a learning subsystem.

Task sheets are documents with assignments that students need to complete. (Depdiknas, 2008: 24) According to the MPT TTUC Bandung Team quoted by Fatmawati et al. (2021), a job sheet is also called a worksheet, which is a printed educational medium that helps instructors in teaching skills, especially in laboratories (workshops), and which contains directions and pictures about how to make or complete a job. Amin and Mayasari (2015: 486) believes that a job sheet is a student work sheet that is equipped with

information related to the topic that will be practiced. Based on the definition above, it can be concluded that a job sheet is a practical work procedure in the form of sheets made by the instructor to be guided by students with the aim of being able to study on one's own, either under or with teacher assistance.

Job sheet has the meaning of the words, namely job, which means activity, and sheet, which means sheet. So a job sheet is a worksheet or activity sheet that contains explanations, orders, and instructions for doing something. A job sheet is an archive that includes all or part of the manufacturing details of an element (Widarto, 2013: 12). Andi (2012: 205–206) states that the function of student worksheets or job sheets includes (a) as teaching material that can reduce the role of educators and also make students more enthusiastic; (b) as teaching material that makes it easier for students to quickly respond to material that is in accordance with their skills competency; (c) as a summary of teaching materials that contains elements of training students' skills; and (d) as practical application.

Job sheets are worksheets that are equipped with information related to the topic to be practiced. Apart from that, job sheets are also used as a guide for students in practical learning independently with or without guidance from the teacher (Amin, 2015: 486). The job sheet structure includes the title, study instructions (student instructions), basic competencies or topics to be completed, illustrative data, assignments, and procedural stages, and assessment (Depdiknas, 2008: 24). According to Dwiyogo in Muga et al., (2017: 261), the learning resources developed are teaching materials in the form of electronic teaching materials. Electronic teaching materials can make it easier to include sound elements and dynamic images, such as videos.

Using E-Job sheets is considered an appropriate learning alternative for students because E-Job sheets through methodical learning exercises, assist students in adding details about the ideas they are learning. This internet-based job sheet will also pamper students' eyes with the appearance of contemporary graphic designs and videos that can add new colors to existing remote sensing learning methods. This e-job sheet is different from job sheets in general; this job sheet is specially designed using a graphic design Canva is the name of the application. With the help of the graphic design tool Canva, educators may create presentation designs, posters, infographics, CVs, and so on. With graphic visuals and good material, it is hoped that the design of this job sheet will be able to help students in the remote sensing learning process more easily absorb the material and practice the desired learning outcomes.

According to Herman (2017: 41), interactive multimedia learning (MPI) is a learning software that uses computer equipment or something similar to combine text, graphics, sound, video, and simulation animations in a way that is integrated and synergistic in order to accomplish certain learning objectives and allow users to actively engage with the program. In MPI, there are three main things that are inseparably related. These three main things are multimedia, learning, and interactive.

According to Widarto (2013: 2), a job sheet contains at least: (1) title; (2) study instructions; (3) competencies to be achieved; (4) supporting information; (5) work steps and tasks; and (6) assessment. In line with this opinion, according to Canci and Rasyid, as quoted by Fatmawati et al. (2021), a complete job sheet has the following things: (1) layout and code numbers; (2) objectives of the work being carried out. will be made, (3) a table of tools and materials to be used, (4) work steps to complete the work, (5) work safety (safety) that must be considered, and (6) an evaluation of learning outcomes.

According to Andi (2011: 205), the function of a worksheet or job sheet is as follows: As instructional materials, they can serve as follows: (1) to reduce the role of the teacher while increasing the role of the student; (2) to facilitate students' understanding of the

material; (3) to be brief and full of practice exercises; and (4) to make teaching to students easier to implement. As per Andi (2011: 206), the objective of creating a job sheet is as follows: Teaching materials that facilitate student interaction with the material; (2) assignments that enhance students' comprehension of the material; (3) instruction in self-directed learning; and (4) facilitation of the practicum activity process for teachers.

According to Fatmawati et al. (2021), making a job sheet must consider several things, namely: (1) starting from the simple to the difficult; (2) work starts from what attracts students' attention; (3) the steps of the work; (4) the scope of the problem emphasizes skills; (5) work that will often be done by students is taught first; and (6) students need opportunities to practice the whole of a job rather than piecemeal.

According to Trianto (2012: 223), the components of a student worksheet or job sheet include the experiment's title, a succinct theory on the subject, the instruments and supplies, the experimental protocols, the observational data and queries, and the results for debate. Widarto (2013) states that the primary content, learning experiences, and fundamental competences found in the curriculum are used to define the title of the work sheet or experiment.

The formulation of the problem in this research includes: (1) Is the Drone E-Job sheet suitable for use in the Class XI Geospatial Engineering Remote Sensing Subject?; (2) Is the Drone E-Job sheet in the Remote Sensing Subject effective for Class XI Geospatial Engineering students?; and (3) Is the Drone E-Job sheet in the Remote Sensing Subject practical for Class XI Geospatial Engineering students?

RESEARCH METHODS

Research and development techniques are used in this study. Using this research methodology, specific items are created and their viability, efficacy, and usefulness are evaluated. The product developed in this research is the development of an e-jobsheet on remote sensing subjects.

This research was carried out at SMK Negeri 1 Percut Sei Tuan Jalan Kolam No. 3 Medan Estate, Percut Sei Tuan District, Deli Serdang Regency, in the 2023-2024 academic year in class XI Geomatics Engineering in the Remote Sensing (Inderaja) subject. The research was conducted in April 2024, namely in the fourth semester (Even) of the 2023–2024 academic year.

The research subjects were classes XI-1 and XI-2 Geomatics Engineering in the Remote Sensing Subject at SMK Negeri 1 Percut Sei Tuan. Class XI-1 Geomatics Engineering has a total of 30 students, and Class XI-2 has 30 students.

In this research, the model used is the 4D development model (four-D model), which was developed by Thiagarajan (1974) and adapted by Sugiyono (2016) into Indonesian into 4P, namely definition, design, development, and dissemination, so that development design refers to the stages of the 4D model. The research procedure for developing the 4D model in this study was adapted from Sugiyono (2016).

In this study, questionnaires were distributed, interviews were conducted, and observation was done to gather data. The instruments used in this study are necessary to gather information about the needs in the field. These include questionnaires on students' needs analysis, interview guide sheets, media validation sheets from experts in the field, material validation sheets from experts in the field, and questionnaires on teachers' and students' reactions to media products. learning.

Media validation by media experts is needed to determine whether the learning media product being developed is appropriate or not. This instrument is in the form of a questionnaire with a rating scale in the form of numbers. The aspects assessed refer to the

learning media assessment instrument by experts created by Citra (2019) and are an adaptation of the aspects in the EMPI (Enterprise Master Patient Index) developed by Crozat et al. (1999) and BSNP (National Board for Professional Certification). The validation sheet grid created by media experts can be seen in Table 1.

Table 1. Validation Sheet Grid for Media Experts

Aspect	Indicator
Display Design	- Text clarity (font size) - Appropriateness in color selection - Suitability of learning support media (pictures, object illustrations) - Navigation button layout - Material design layout - Distance settings (spacing)
Accessibility	- Accessibility of icon buttons and menu buttons - Application loading process
Use of Language	- Accuracy of language use (in accordance with EYD rules, no double meaning, easy to understand)
Implementability	- Ease of accessing the application - Helping students learn independently - Installation process

(Source: Citra, 2019)

Validation by material experts is needed to determine the suitability of the material presentation with students' cognitive development. This instrument is in the form of a questionnaire with a rating scale. The following is a grid of media validation instruments by material experts as in Table 2 below.

Table 2. Validation Sheet Grid for Material Experts

Aspect	Indicator
Curriculum	- Suitability of material to the curriculum and learning objectives
Presentation of Material	- Well structured material (from easy to difficult, adjusted to students' cognitive development) - Make it easier for students to understand the material
Use of Language	- Accuracy of language use (in accordance with EYD rules, no double meaning, easy to understand)
Evaluation	- Appropriateness of the question with cognitive development - Suitability of questions to the concept of the lesson given.. - Suitability of questions to competencies or learning objectives

(Source: Citra, 2019)

Validation by learning design experts is an important process to ensure that the product being developed is effective, relevant, and in accordance with the principles of good learning design. This instrument is in the form of a questionnaire with a rating scale. The following is a grid of validation sheets by learning design experts which can be seen in Table 3.

Table 3. Validation Sheet Grid for Learning Design Experts

Aspect	Indicator
Learning Design	- Accuracy of Topic Selection - Suitability of material to learning objectives - Providing training - Consistency of tests with learning objectives
Information Design	- Providing motivation - Use of Study Guides - Clarity of material description - Clarity of the examples given - Feedback on student learning test results - Explanation of terms - Ease of use
Presentation Design	- Color composition - Use of graphics - Selection of font type and size - Use of navigation buttons - Image and animation quality - Use of music

The teacher and student response questionnaire is in the form of a rating scale (graded scale) with five assessment categories from the lowest, namely: 1, 2, 3, 4, and 5. The teacher response questionnaire aims to find out the response or opinion of teachers in remote sensing subjects regarding the product developed learning media. Meanwhile, the student questionnaire aims to find out students' responses or opinions regarding the product being developed as well as the practicality of the product being developed.

Table 4. Teacher Response Questionnaire Grid to E-Jobsheet

Aspect	Indicator
Display Design	- Text clarity - Media design - Zoom in feature
Accessibility	- Ease of accessing buttons (icon buttons and menu buttons)
Supporting Media	- Supporting media (images, animated moving images, and videos) make it easier for students to understand the material - Suitability of the use of supporting media (images, animated moving images and videos) with the material presented - The role of supporting media (images, animated moving images, and videos) in increasing interest
Practice and Evaluation	- Suitability (practice questions, mini quizzes, and evaluation questions) with the concepts presented - Awards (rewards) given after working on practice questions on the application
Implementability	- Ease of accessing media - The use of media supports students in independent learning - The loading process in running the application

(Source: Citra, 2019)

Table 5. Student Response Questionnaire Grid to E-Jobsheet Media

Aspect	Indicator
Display Design	- Text clarity - Media design
Accessibility	- Ease of accessing buttons (icon buttons and menu buttons)
Understanding Material	- Material Arrangement - The role of supporting media (images, animated moving images, and videos) in increasing interest in learning - Understanding the material through E-Jobsheet media - Use of audio
Practice and Evaluation	- Suitability of practice questions, mini quizzes, and evaluation questions with the concepts presented - Ease of answering questions in the application
Implementability	- Ease of accessing the application - The role of E-Jobsheets in increasing motivation - Study - Ability to use applications - Loading process

(Source: Citra, 2019)

The formative test for students is in the form of multiple choice questions with five assessment categories, namely: a, b, c, d and e. This formative test aims to determine learning outcomes in remote sensing subjects regarding the learning media products being developed. The student learning outcomes grid can be seen in Table 6.

Table 6. Grid of Student Learning Results on E-Jobsheet Media

Material	Question Indicator	Cognitive Level
Maps, Remote Sensing	- An explanation of the recording system in remote sensing is presented. Students can differentiate recording systems in remote sensing.	C3,C4
	- Students can analyze photo images.	C3,C4
	- Students can classify the image interpretation hierarchy	C4,C5
	- Using data collection equipment on the earth's surface (Ground Truth)	C4, C3
	- Students can explain the elements of image interpretation and students can apply the benefits of remote sensing	C4, C5

The results of the assessment by experts in the form of numbers are given an assessment score according to the conditions in Table 7 below:

Table 7. Scoring Terms and Media Quality

Evaluation	Score	Percentage	Criteria
5	4,20 - 5,00	81% - 100%	Very Appropriate
4	3,40 - 4,19	61% - 80%	Appropriate
3	2,60 - 3,39	41% - 60%	Fair
2	1,80 - 2,59	21% - 40%	Less Appropriate
1	1,00 - 1,79	≤ 20%	Not Eligible

(Source: Akdon and Riduwan (2013:16)

Table 8. Criteria for Answering Validation Instrument Items and Their Scores

No	Answer	Score
1	Very Good	4
2	Good	3
3	Not Good	2
4	Not Good	1

(Source: Sugiyono 2011)

Table 9. Validation Questionnaire Assessment Guidelines

Scale	Criticism of the Product
1	Not agree/not good/not suitable/less understanding/less interesting/less understanding/less easy/less worthy/less useful/less motivating/less active
2	Sufficiently agree/quite well/quite suitable/quite easy/quite understandable/quite feasible/quite interesting/quite understandable/quite useful, quite motivating/quite active.
3	Agree/good/suitable/easy/understand/interesting/understanding/decent/useful/motivating/ active.
4	Very agree/very good/very suitable/very understanding/very interesting/very understanding/very useful/very motivating/very active easy/very feasible/very active.

(Source: Sugiyono 2011)

Testing the effectiveness of this research was carried out using experiments and carrying out treatment controls to obtain truly valid data. The treatment in this research was given to experimental group research subjects.

Testing the effectiveness of this an approach known as quasi-experimental research was used. By contrasting the post-test results of students who utilized the created E-Jobsheet with those of students who employed printed books, this study also performed treatment control.

Group A is an experimental class that will be given treatment using E-Jobsheets in the Remote Sensing learning process, while Group B is a control class that uses printed books where the teacher explains the lesson material and continues with giving assignments for students to complete. The two groups were determined by drawing lots using coins. Learning outcome tests were given to both groups following five learning sessions in order to ascertain how the experimental class group and the control class differed in terms of average learning outcomes.

The H1 testing criteria is accepted if tcount > ttable obtained from the t distribution list with degrees of freedom dk = n1 + n2 - 2, and a significance level of 5%. Miarso (2004) said that learning effectiveness is often measured by the achievement of objectives. Learning effectiveness refers to the level of consistency of experience, in this case the learning process with learning objectives (Fitria et al. 2017: 17).

One indicator of learning effectiveness is students' remote sensing learning outcomes (Wahyuddin & Nurcahaya, 2019: 80). The effectiveness value of the E-Jobsheet is obtained based on the percentage of classical completeness, which is then categorized based on a minimum learning completeness standard of 75 in the Remote Sensing subject, where the effectiveness criteria are met if students achieve completeness greater than or equal to 75%.

RESULTS AND DISCUSSION

The initial design or prototype includes the design of learning media used to collect data needed during the product development process, in accordance with the results of analysis from previous stages. This stage produces an initial version of the prototype, which will be

developed further in the next stage until the product is finished.

Figure 1. Prototype and E-Jobsheet project design display

The results of research and product development based on material suitability, media suitability, and learning design suitability are validated by several experts according to their competence. The data obtained from validation results from experts are as follows:

Table 10. Material Expert Validation Results Data

No	Assessment Aspects	Item	Assessment Indicators	Score		Criteria
				V1	V2	%
1	Curriculum	1	Suitability of material to learning outcomes (CP)	5	4	80%
		2	Suitability of material to learning objectives (TP)	4	5	90%
2	Overview	1	The cover design depicts Inderaya's learning	5	5	100%
		2	E-Jobsheets are designed according to student characteristics	5	5	100%
		3	Adequate references/reading sources..	5	4	90%
3	Presentation of Material	1	The material is arranged progressively, from easy to difficult	4	4	80%
		2	The composition of the material takes in to account the level of understanding based on students' cognitive development.	5	4	90%
		3	Material is presented in various formats that can be adapted to students' learning styles, such as text, images or videos	4	4	80%
		4	The material is equipped with relevant examples	4	4	80%
		5	Presentation of material raises students' conceptions	5	4	90%
4	Use of Language	1	The material is presented in language that consistently follows EYD rules.	4	5	90%
		2	The material is presented in language that is easily understood by students of various levels of understanding.	5	4	90%
5	Evaluation	1	Suitability of questions to cognitive development.	5	5	100%

No	Assessment Aspects	Item	Assessment Indicators	Score		Criteria
				V1	V2	%
		2	Suitability of questions to the concept of the lesson given.	5	5	100%
		3	Suitability of questions to competencies or learning objectives	4	5	90%
Total scores obtained from Material Experts				69	71	
The total ideal score for all items				75	75	
Percentage				92.0%	94.66%	
Average				93.3%		

Table 11. Data from Media Expert Validation Results

No	Assessment Aspects	Item	Assessment Indicators	Score		Criteria
				V1	V2	%
1	Appearance and Layout Design	1	Selection of appropriate and legible typeface	5	4	90%
		2	Select appropriate and legible font size	4	3	70%
		3	Choosing matching colors	5	5	100%
		4	Use of relevant images and illustrations	5	5	100%
		5	Instrumental music supports the learning atmosphere	5	4	90%
		6	Inclusion of relevant links/barcodes for additional material sources.	5	4	90%
		7	Suitability of the layout of the material presented	4	4	80%
		8	The spacing between paragraphs is consistent.	4	4	80%
		9	The animation displayed is in accordance with the message or material conveyed.	4	4	80%
		10	Tools E-Jobsheet Taplink works well	3	4	70%
2	Navigation	1	Instructions for using EJobsheet are simple and easy to understand.	4	4	80%
		2	The use of language in the E-Jobsheet is in accordance with EYD	5	4	90%
3	Use of Language	1	The language used is easy to understand and does not have double meaning	4	4	80%
		2	Easily access EJobsheet on various devices	5	4	90%
4	Implementability	1	E-Jobsheet provides materials and features that enable independent learning.	5	3	80%
		2	The E-Jobsheet installation process is easy.	4	5	90%
Total scores obtained from Media Experts				71	65	
The total ideal score for all items				80	80	
Percentage				88.75%	81.25%	
Average				85%		

Table 12. Data from Validation Results from Learning Design Experts

No	Assessment Aspects	Item	Assessment Indicators	Score		Criteria
				V1	V2	%
1	Appearance and Layout Design	1	Accuracy of Topic Selection.	5	5	100%
		2	Suitability of material to learning objectives	5	4	90%
		3	Providing training	4	4	80%
		4	Consistency of tests with learning objectives	5	4	90%
2	Information Design	1	Motivation is available.	4	5	90%
		2	Use of Study Instructions	4	3	70%
		3	Clarity of material description	5	4	90%
		4	Clarity of examples given	5	4	90%
		5	There is feedback on student learning test results	5	4	90%
		6	Explanation of terms	5	4	90%
		7	Ease of use	4	5	90%
3	Use of Language	1	Color composition	5	4	90%
		2	Graphics usage	5	4	90%
		3	Selection of font type and size	5	4	90%
		4	Use of navigation buttons	5	4	90%
		5	Image and animation quality	5	4	90%
		6	Use of music	5	4	90%
Total scores obtained from Learning Design Experts				81	70	
The total ideal score for all items				85	85	
Percentage				95.29%	82.35%	
Average				88.82%		

Overall, the assessment results from material, media and learning design expert validators show that the development of the E-Jobsheet Drone learning media has met the feasibility requirements and can be tested in Remote Sensing learning. A recapitulation of the final validation results by expert lecturers can be seen in Table 13 below:

Table 13. Recapitulation of Validation Results by Expert Lecturers

No	Assessment Category	Average Percentage	Criteria
1	Learning Design Validation	88,82%	Very Eligible
2	Media Validation	85,00%	Very Eligible
3	Material Validation	93,33%	Very Eligible

The practicality trial of this learning media was carried out by the subject teacher. Remote Sensing. The assessment consists of three aspects: appropriateness of content, quality (technical/appearance), and usefulness of the interactive learning media product being developed. Below, Table 14 presents data on the results of responses given by Remote Sensing teachers in utilizing this learning media.

Table 14. Teacher Response Data Results

No	Assessment Category	Average Percentage	Criteria
1	Display Design	91,65%	Very Eligible
2	Accessibility	90,25%	Very Eligible

3	Supporting Media	88,50%	Very Eligible
4	Practice and Evaluation	85,50%	Very Eligible
5	Implementation	93,33%	Very Eligible
	Average	**89,84%**	Very Eligible

Table 15. Recapitulation of Trial Results

No	Assessment Category	Average Percentage	Criteria
1	Individual Trial	87,86%	Very Eligible
2	Small Group Trials	89,10%	Very Eligible
3	Field Trials	91,00%	Very Eligible
	Average	**89,32%**	Very Eligible

The calculation result of the normality test for the control and experimental Ltable classes at the 5% significance level with n = 30 is 0.131. This indicates that the sample originates from a population that has a normal distribution since Lcount < Ltable. Table 16 presents an overview of the normalcy test results for the two research samples.

Table 16. Summary of Data Normality Test Results

No	Data	Class	Lcount	Ltable	Conclusion
1	*Post-test*	Experiment	0,130	0,131	Normal
2		Control	0,130	0,131	Normal
3	*Pre-test*	Experiment	0.119	0.131	Normal
4		Control	0.123	0.131	Normal

The two groups of sample data are normally distributed, according to the findings of the pre- and post-test data normality tests in the two classes or samples. The Appendix contains the computations for the homogeneity test. The homogeneity test results for the two research samples are summarized in the table that follows.

Tabel 17. Summary of Data Homogeneity Test Results

No	Data	Class	Fcount	Ftable	Conclusion
1	*Post-test*	Experiment	0,31	1,861	Homogeneous
2		Control			
3	*Pre-test*	Experiment	0,858	1,861	Homogeneous
4		Control			

In Table 17 above, you can see the Fcount < Ftable value, namely 0.310 < 1.861 for the pre-test, and the Fcount < Ftable value, namely 0.858 < 1.861 for the post-test, which means the data in the research sample has the same or homogeneous variance.

Hypothesis testing in the research was carried out to determine the effectiveness of the product being developed and to determine if the learning outcomes for remote sensing in classrooms using Taplink-based E-Jobsheet Drones (the experimental class) and the learning outcomes for remote sensing in classes using printed books (the control class) differed significantly. The independent sample t test is used to evaluate this hypothesis during the learning process. With a two-tail test value of $\alpha = 0.05$. H0 is accepted and H1 is rejected according to the independent sample t test's premise that if the test's significance value is greater than 0.05. This indicates that there is no difference in the learning outcomes for remote sensing between utilizing the Taplink-based E-Jobsheet Drone learning medium and not using it. In contrast, if the t test's significance value is less than

0.05, H0 is disproved and H1 is accepted. The t test results (Independent Samples t) are shown in Table 18 below.

Table 18. Independent Samples Test Results

	Experiment	Control
Mean	84.33	74.83
Variance	68.85	52.56
Observations	30	30
Pooled Variance	60.70	
Hypothesized Mean Difference	0	
df	58	
t Stat	4,72	
P(T<=t) two-tail	0,066	
t Critical two-tail	2,001	

Based on Table 18, tcount = 4.722 and ttable = 2.002, with a significance level of α = 0.05, so tcount > ttable. It can be interpreted that H1 is approved while H0 is refused. The average learning outcomes of students who utilize the Taplink-based Drone E-Jobsheet thus differ significantly from those of students who do not use the Taplink-based Drone E-Jobsheet in remote sensing subjects.

Discussion

This research aims to produce taplink-based EJobsheet Drone learning media for remote sensing subjects at SMK Negeri 1 Percut Sei Tuan. The product development process follows the 4D model stages. The development of the Taplink-based drone e-jobsheet for remote sensing subjects has been carried out in accordance with 4D model research and development procedures. The stages that have been passed in this development research are as follows:

First, the analysis stage is carried out by identifying needs through observing the learning process in remote sensing subjects and interviews. Next, a curriculum analysis is carried out to understand the curriculum and teaching materials used. Then, material analysis was carried out to determine the material that would be included in the Taplink-based Drone E-Jobsheet based on Learning Achievements (CP), Learning Objective Flow (ATP), and Learning Objectives (TP) in the Remote Sensing subject. This analysis stage is in line with the instructional design stage in the 4D development model.

Second, the design stage in creating a Taplink-based E-Jobsheet Drone includes selecting the Taplink application as the tool used to develop the E-Jobsheet Drone. Apart from that, this stage also involves determining the data structure, which consists of teaching materials, learning media, assessments, reflections, and assessment rubrics. Next, a storyboard and menu display for the Taplink application were designed. This design is carried out with the aim of creating media that is in accordance with the needs of students.

Third, the E-Jobsheet Drone product development stage for remote sensing subjects using the Canva application is based on the design that was created at the design stage. After the product has been developed, validation is carried out by material, design, and media experts. The EJobsheet Drone learning medium that was developed was then revised according to input from experts. The second and third stages correspond to the 4D development model.

The last is the dissemination stage, where implementation is carried out at SMK Negeri 1 Percut Sei Tuan for teachers and students of class XI Geomatics Engineering. Students

were divided into two groups, namely class XI-1, which acted as an experimental group with 30 students, and class XI-2, which acted as a control group with the same number of students.

The product development research aims to produce a Taplink-based drone e-jobsheet for students of SMK Negeri 1 Percut Sei Tuan. This product is designed to improve the quality of learning and student achievement in remote sensing subjects.

Based on validation results by expertise in materials, media, and design, in addition to product trials that include individual and small group trials, the Drone E-Jobsheet for Remote Sensing subjects is considered very suitable for use. All experts gave very decent assessments, with an average validation score for material experts of 93.33%, media experts of 86.25%, and design experts of 88.82%. The individual trial scored 87.86%, and the small group trial scored 89.10%, indicating excellent feasibility. Thus, this product is recommended for use as a learning medium in class XI of SMK Negeri 1 Percut Sei Tuan.

According to Amrulloh (2013), to ensure the theoretical feasibility of a learning medium, it is important to involve assessments from media experts, material experts, and subject teachers. Material feasibility involves an assessment media feasibility comprises an assessment of the format, quality, and conceptual fit of the media, whereas content suitability refers to how well the media aligns with concepts and learning objectives. The learning medium is deemed theoretically possible and appropriate for use in the learning process if these two requirements are met. Arsyad (2014: 217) asserts that an evaluation of the learning design entails an evaluation of the media utilized if learning media is created as a fundamental component of the learning process.

Based on the description above, it can be concluded that the Drone E-Jobsheet for Remote Sensing subjects can be considered effective as a good learning medium if it meets the criteria for being suitable for use by students. This is in accordance with the results of product development, which show a very good level of feasibility in developing this medium.

When a field trial was carried out involving 30 students, this product obtained practical results of 91% (very feasible). Apart from that, the response from the Remote Sensing subject teacher, who acts as a practitioner validator in the use of the Drone E-Jobsheet, showed an assessment of 89.84% (very feasible).

It is clear from this data that teachers and students make effective use of the E-Jobsheet Drone. This is consistent with the product's outcomes development, which have been proven to be very feasible and meet the expected standards.

Testing the effectiveness of the E-Jobsheet Drone product being developed was done by comparing the average value of learning outcomes for the control class, which only used printed books in the learning process, and the experimental class, which used the E-Jobsheet Drone. The results showed that the learning outcomes for the control class were 74.83 and 84.33, respectively on the material Taking Photogrammaterial on a UAV, which was carried out in class XI of SMK Negeri 1 Percut Sei Tuan with a total of 30 students in each class. Furthermore, from the results of the T test, tcount = 4.72 and ttable = 2.002, with a significance level of $\alpha = 0.05$, so that tcount > ttable. It can be interpreted that The fact that H0 is rejected and H1 is accepted indicates that the E-Jobsheet Drone product is useful for enhancing student learning results in remote sensing-related courses.

According to Nieveen (1999: 127), the effectiveness of a learning tool can be assessed by how well students appreciate or respond to it in the learning process. In other words, the level of effectiveness of the teaching materials developed is evident from the learning objectives that pupils have met.

It may be inferred that E-Jobsheet Drones is a useful tool for remote sensing education based on conducted research and theories supporting its application. Furthermore, the vital role that educators play as proficient guides in integrating technology into the teaching and learning process has a big impact on students' academic performance, motivation, and excitement for learning.

CONCLUSION

The following are the conclusions that can be made:

1. The creation of Drone E-Jobsheets demonstrates that the media created is appropriate for use in remote sensing learning in classroom XI at SMK Negeri 1 Percut Sei Tuan. This process involves gathering data, assessing student needs and characteristics, creating learning materials, designing and developing products, validating and revising them, and conducting product trials. The average assessment from instructors and students was 89.47%, and the average validation results from experts were 89.05%; both of these scores fell into the "Very Eligible" category.
2. When compared to traditional teaching techniques, the Drone E-Jobsheet product has demonstrated efficacy in enhancing student learning outcomes. At a significance level of 5%, the hypothesis test findings indicate that the t value of 4.722 is greater than the t table of 2.002. This shows that learning using the E-Jobsheet Drone significantly improves remote sensing learning outcomes, with an effectiveness level reaching 84.33% compared to conventional methods, which have an effectiveness level of 74.83%.

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