I Gusti Putu Asto Buditjahjanto <asto@unesa.ac.id>

[jpv] Submission Acknowledgement

2 messages

Editorial Team of Jurnal Pendidikan Vokasi <jpvokasi@uny.ac.id> Fri, Aug 28, 2020 at 7:24 PM
To: Dr I Gusti Putu Asto Buditjahjanto <asto@unesa.ac.id>

Dr I Gusti Putu Asto Buditjahjanto:

Thank you for submitting the manuscript, "DEVELOPMENT OF ROBOT TRANSPORTER LEARNING MEDIA TO LEARN MICROCONTROLLER" to Jurnal Pendidikan Vokasi. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

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I Gusti Putu Asto Buditjahjanto <asto@unesa.ac.id> Fri, Aug 28, 2020 at 11:29 PM
To: Editorial Team of Jurnal Pendidikan Vokasi <jpvokasi@uny.ac.id>

Thank you for your mail.

Dr. I.G.P. Asto Buditjahjanto, S.T.,M.T.
Faculty of Engineering
The State University of Surabaya
(Universitas Negeri Surabaya)
Indonesia

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[jpv] Editor Decision

2 messages

Editorial Team of Jurnal Pendidikan Vokasi <jpvokasi@uny.ac.id> Sat, Dec 19, 2020 at 9:59 AM
To: Dr I Gusti Putu Asto Buditjahjanto <asto@unesa.ac.id>
Cc: Chandra Ainur Rizqi <chandra.ainur@gmail.com>, Bambang Suprianto <bangjosp@yahoo.com>

Dear Dr I Gusti Putu Asto Buditjahjanto:

We have reached a decision regarding your submission to Jurnal Pendidikan Vokasi, "DEVELOPMENT OF ROBOT TRANSPORTER LEARNING MEDIA TO LEARN MICROCONTROLLER".

Our decision is: Revisions Required.

Please refer to the reviewer's comments and suggestions in revising the manuscript.
We expect to have the revised manuscript back to us before: 27 December 2020.

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To: Editorial Team of Jurnal Pendidikan Vokasi <jpvokasi@uny.ac.id>
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Indonesia

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[jpv] Editor Decision

1 message

Editorial Team of Jurnal Pendidikan Vokasi <jpvokasi@uny.ac.id> Wed, Dec 30, 2020 at 11:24 PM
To: Dr I Gusti Putu Asto Buditjahjanto <asto@unesa.ac.id>
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Dear Dr I Gusti Putu Asto Buditjahjanto:

We have reached a decision regarding your submission to Jurnal Pendidikan Vokasi, "Developing robot transporter learning media to learn microcontroller".

Our decision is to: Accept your submission for publication in Jurnal Pendidikan Vokasi.

We will contact you soon for further administrative concerns.

Thank you.

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Editor
2020-12-19 09:59 AM

Subject: [jpv] Editor Decision DELETE

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Editor
2020-12-30 11:24 PM

Subject: [jpv] Editor Decision DELETE

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Article Publishing Cost (APC)

2 messages

Jurnal Pendidikan Vokasi Jurnal Pendidikan Vokasi PPS UNY <jpvokasi@uny.ac.id> Wed, Dec 30, 2020 at 11:29 PM
To: asto@unesa.ac.id, chandra.ainur@gmail.com, bangjosp@yahoo.com

Kepada Yth./Bapak/Ibu/Sdr. I Gusti Putu Asto Buditjahjanto, Chandra Ainur Rizqi, Bambang Suprianto
Authors of a manuscript entitled "Developing robot transporter learning media to learn microcontroller"

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0005801500062814 - IDR
To Account:
0468970056 - IDR
Destination A/C Name:
SORI RIRIN SUSETYANINGSIH
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#34140 Summary

SUMMARY REVIEW EDITING

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Authors	I Gusti Putu Asto Buditjahjanto, Chandra Ainur Rizqi, Bambang Suprianto
Title	Developing robot transporter learning media to learn microcontroller
Original file	34140-90614-1-SM.DOCX 2020-08-28
Supp. files	None
Submitter	Dr I Gusti Putu Asto Buditjahjanto
Date submitted	August 28, 2020 - 07:24 PM
Section	Articles
Editor	Pardjono Pardjono
Abstract Views	0

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Article Submission	0.00 IDR	PAY NOW
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Article Publication	Paid December 31, 2020 - 09:47 PM	

Status

Status	Published Vol 10, No 3 (2020)
Initiated	2020-12-31
Last modified	2021-04-21

Submission Metadata

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Country	Indonesia
Bio Statement	—

Principal contact for editorial correspondence.

Name	Chandra Ainur Rizqi
Affiliation	Universitas Negeri Surabaya
Country	Indonesia
Bio Statement	—
Name	Bambang Suprianto
Affiliation	Universitas Negeri Surabaya
Country	Indonesia
Bio Statement	—

Title and Abstract

Title: Developing robot transporter learning media to learn microcontroller

Abstract

Learning media play a role in bridging the interaction between the teacher and students. Using learning media can help students to understand the material delivered by the teacher more efficiently. Al Kholiliyah, a Vocational High School in Bangkalan, Indonesia, still lacks interactive learning media to motivate students in learning. The robot transporter as an interactive learning medium can be applied to solve the lack of learning media that engage students in learning. The purpose of this study is to analyze the validity of the robot transporter as learning media, to analyze the validity of the learning plan (a syllabus, a lesson plan, a student worksheet) of robot transporter learning media, and to analyze the student response of the usage robot transporter learning media. The validation results of the robot transporter learning media show that the value of the validity is 3.89, categorized as very valid. The validity of the syllabus is 3.78, categorized as very valid, the validity of the lesson plan is 3.88, categorized as very valid, and the validity of the student worksheets is 3.89, categorized as very valid. The results of student responses show that there are two responses: strongly agree and 28 responses with the category of agree. Based on the robot transporter validity, the learning plan validity, and the student response, it can be concluded that the robot transporter can be used in the teaching and learning process.

Indexing

Keywords	robot transporter; learning media; validation; microprocessor
Language	en

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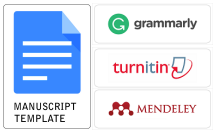
Agencies	Ministry of Education and Culture

References



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#34140 Review

SUMMARY **REVIEW** EDITING

Submission

Authors	I Gusti Putu Asto Buditjahjanto, Chandra Ainur Rizqi, Bambang Suprianto
Title	Developing robot transporter learning media to learn microcontroller
Section	Articles
Editor	Pardjono Pardjono

Peer Review

Round 1

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DEVELOPMENT OF ROBOT TRANSPORTER LEARNING MEDIA TO LEARN MICROCONTROLLER

Anonymous

Abstract

Learning media play a role in bridging the interaction between the teacher and students so that students can capture the material delivered more efficiently. The robot transporter is an alternative media that needs to be developed because the use of learning media at the Al Kholiliyah Vocational High School in Bangkalan, Indonesia is still very lack. The study is aimed to analyze the validity of robot transporter as learning media, to analyze the validity of the learning plan (syllabus, lesson plan, student worksheet) of robot transporter learning media and to analyze the student response of the usage robot transporter learning media. Regarding the validation results of the robot transporter learning media, the value of the validity is 3.89 with categorized as very valid. The validity of the syllabus is 3.78 with categorized as very valid, the validity of the lesson plan is 3.88 with categorized as very valid, and the validity of the student worksheets is 3.89 categorized as very valid. The results of student response show that from 30 questions for the students there are two responses with the category are Strongly Agree and 28 responses with the category are Agree. Thus it can be concluded that robot transporter learning media can be used in teaching and learning at a Vocational High School.

Keywords: *robot transporter, learning media, validation, microprocessor,*

Comment [A1]: Need rewritten to improve your language

Comment [A2]: This sentence uses complex one, it needs to be rewritten using a good English structure

Comment [A3]: The purpose of this study is….

Comment [A4]: The robot transporter

Comment [A5]: delete

Comment [A6]: wrong sentences in English structure

Comment [A7]: this sentence need to be improve to emphasized results of your research.

INTRODUCTION

The development of learning media is one of the steps to improve the education system. Learning media is defined as equipment that helps during the teaching and learning process (Apriyus, Rukun, Huda, & Marta, 2020). Learning media has a broad scope, including people, material, or study, that creates a situation where students can acquire knowledge, skills, or attitudes (Daryanto, 2010). The form of learning media can consist of hardware, such as computers, TVs, projectors, and also the software used on these hardware devices (Baharuddin & Daulay, 2017), (Sarwandi, Giatman, Sukardi, & Dedy, 2019). In other words, learning media can be used to generate thoughts, feelings, attention, abilities, and skills of students, thus encouraging the learning process (Nunuk & Leo, 2012). The developed learning media make the teaching and learning process run optimally, undoubtedly.

As a communication process in a system, the learning media occupies a reasonably necessary place in the learning system's components. Learning media play a role in bridging the interaction between the teacher and students so that students can capture the material delivered more efficiently (Sadiman, 2010). In the process of reading material, sometimes, there are various things that students cannot accept optimally. For example, when the teacher teaches the basics of electronics, then using learning media in the form of visual diagrams, photos, videos, or the physical structure of the series, students will be able to capture the material presented by the teacher to the fullest (Mayer & Richard, 2001). Without the media, communication will not occur, and the learning process will not take place properly.

SMK Al Kholiliyah, a private Vocational High School in Bangkalan, East Java, Indonesia has a problem teaching Microcontroller subjects to the students because of a lack of learning media and the difficulty of the subject. Microcontroller subjects aim to provide necessary skills to students that can be applied to society. Meanwhile, Basic Competitions in microcontroller subjects include making simple application programs and demonstrating the program so that students can adequately master and understand the skills being taught according to specific competencies. Therefore, it is needed a learning media that can solve those problems. The use of a learning media can help students gained their learning motivation (Haryawan & Salechan, 2017).

The robot transporter is chosen based on recommendations from various parties, including the teachers at SMK Al Kholiliyah. The recommendation to use robot transporter as learning media is because it consists mostly of the microcontroller systems. Therefore, by learning robot transporter, students can learn a thorough microcontroller system. Moreover, the robot transporter learning media can help students apply robots to technological developments.

This research produces a product called robot transporter using microcontroller-based android applications. The robot transporter as learning media is used as a bridge between students and a learning material microcontroller to ease the students to understand it. Therefore the usage of robot transporter can help to improve student learning outcomes. Based on that description, the research objectives are to analyze the validity of robot transporter learning media, analyze the validity of the learning plan of robot transporter learning media, and to analyze the student response of the usage robot transporter learning media.

RESEARCH METHOD

Design of the research

This research used the research and development (R&D) method to develop robot transporter learning media. This method was chosen because it has a simple procedure and a systematic procedure according to the research problem that researchers did. The R&D method is recognized as capable to produce specific products and also capable to test the effectiveness of those products (Sugiyono, 2013). This research adopted the R&D method, including potential and problems, data collection, product design, design validation, design revision, product testing, product revision, and product implementation.

Comment [A8]: This quality of section needs to be improved by academic writing. The relevant literature studies also need to be improved and add on the strengthen your paper. The evidence can be shown by adding more citations from the latest studies. This introduction lacks literature studies.

Comment [A9]: This paragraph should describe the research motivation, but the main topic of this paragraph talks about definition of learning media with supporting sentences. It is not necessary because many people have known it.

Comment [A13]: The fourth paragraph suddenly describe robot transporter. It has not been mentioned in previous paragraph, so reader will ask questions where this robot comes from. It will be better to add some sentences in previous paragraph to bridge this one. Further, the English structure of this paragraph need to be rewritten to improve the quality.

Comment [A14]: This topic in paragraph is not appropriate because it has similar topic with previous one. It will be better to combine these two paragraphs and make it shorten. The topic of this paragraph has to be emphasized on the research contributions/purposes and hypotheses. Moreover, the English structure need to be rewritten

Comment [A10]: In paragraph two, the idea talks about the function of leaning media. It is good, but the English structure need to be improve using academic writing. Hence, the reader will understand easily.

Comment [A11]:

Comment [A15]: Could ypu explain why you write "This research used the research and development (R&D)". it will make the reader confuse.

Comment [A12]: The third paragraph describes about the teaching problem at SMK Al Kholilyah, and how to solve it. It is good idea, but your English structure is not good and need to be rewritten improve the quality.

Comment [A16]: This sentence is not good to be written in this section. The method is chosen because the researchers need it as relevant method to answer the research problems, not due to simple procedure or systematic procedure.

Comment [A17]: Many people know it and it is only research method definition. you have to talk about the relation with your research topic.

Comment [A18]: This sentence is difficult to be understood. You have rewritten using good English structure

Population and sample

The population of this study is all Vocational High Schools in Bangkalan, East Java, Indonesia. While the sample used is the class X TEI 1 at SMK Al Kholiliyah with 30 students.

Potential and problems

The researcher firstly made observations to the class X TEI 1 at SMK Al Kholiliyah. The problem that occurs at this Vocational High School was the lack of media to teach and learn a microcontroller subject. Therefore, to develop a learning media that able to attract students' intention to learn a microcontroller, the robot transporter was chosen as the potential to provide added value.

Data collection

The data is collected through the use of instruments to obtain the validity of the transporter robot learning media and learning plan that accompanies the learning media. The development and the usage of the instrument were also capable to measure student responses after using the learning media.

Procedures

The procedure of this research started with creating a robot transporter learning media following the needs of the microprocessor learning process at SMK Al Kholiliyah. For this learning media can be used for the learning process, it is necessary to make a learning plan that includes syllabus, lesson plans, and student worksheets that support the use of these learning media. Furthermore, validation was carried out both on the learning media and learning plan. Validation was carried out by three experts in their fields. After getting validation and making revisions according to the input of the experts, then the learning media and learning plan can be implemented in the classroom. To find out how big the role and benefits of the learning media were, and then measuring the response of students as users of the media is carried out.

Product design

This research built a robot transporter as learning media. Figure 1 shows a design robot transporter. This robot transporter consists of Bluetooth Module, DC source, Microcontroller ATMega8, and DC Motor Module. The Bluetooth Module acts as a communication tool between the ATMega8 Microcontroller on the transporter robot and the user's Android Smartphone. The DC source supplies electricity to the ATMega8 Microcontroller and becomes the driving force for the DC Motor Module. The ATMega8 microcontroller contains a program to move back and forth and move the robot clamp according to user input commands controlled via an Android Smartphone. Meanwhile, the DC Motor Module functions to drive two motors according to the commands from the ATMega8 microcontroller.

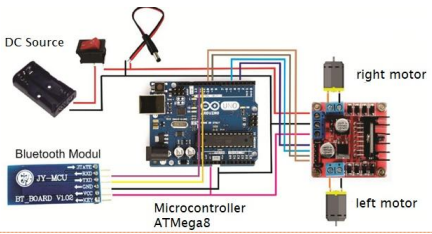

Figure 1. Design Robot Transporter

Figure 2 shows the application of the Bluetooth RC controller system installed on the Android 4.2 Smartphone. When the application opened, the main menu appears and then activates Bluetooth. After Bluetooth is received, each application button sends logic that is processed by the microcontroller to move the robot transporter

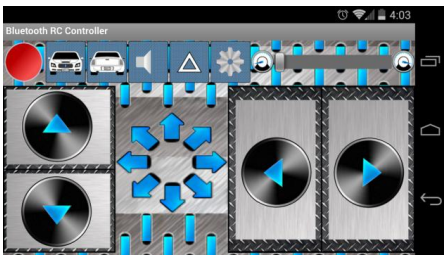

Figure 2. Display Bluetooth RC Controller on Smartphone

This robot transporter consists of 2 main parts, namely, a mobile robot and a

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clamp robot. Figure 3 shows the figuration of robot transporter learning media.

Figure 3. The Figuration of Robot Transporter Learning Media

Instruments

Design validation and design revision

After this learning media was made, the next step was to develop some instruments to assess the validity of the learning media, whether it was valid or not. Three experts were selected based on their expertise to assess the validity of the learning media. The instruments compiled consist of the validation instrument of robot transporter learning media, validation instrument of robot transporter learning plan (syllabus, lesson plans, and student worksheets), and validation instrument of student response.

Table 1 shows the validation instrument of robot transporter learning media. This instrument consists of three constructs, namely content, feature format, and language. Content with eight indicators, feature format with nine indicators, and language with five indicators

Table 1. Validation Instrument of Robot Transporter Learning Media

No.	Aspect / Indicator
Content	
1	The learning material suitability with learning objectives.
2	Suitability with students' thinking level.
3	Completeness of the learning material.
4	Learning material accuracy.
5	Learning material is organized based on its structure.
6	The material depth is based on its structure.
7	The material suitability with the level of student development.
8	The connectivity between the ongoing material with the previous material.
Feature format	
9	Using harmless materials
10	Easy material for assembly
11	Tools are functioned according to the program
12	Software is easy to obtain
13	Software is easy to operate
14	Spare part is easy to obtain
15	he components compatibility with the material
16	The presence of a Bluetooth feature
17	The tool can function normally
Language	
18	Language is easy to understand.
19	Language according to general guidelines for Indonesian spelling.
20	The language used can explain the material presented.
21	Language suitability.
22	Language in learning materials is communicative.

Table 2 shows the validation instrument of the syllabus. This instrument consists of 11 constructs such as the identity of the education unit/school, subject identity, class/education level, main competencies, basic competencies, indicator, subject matter, learning, assessment, time allocation, and learning resources. The number of indicators for all constructs is 30 items.

Table 2. Validation Instrument of The Syllabus

No.	Assessment Indicators
The identity of the education unit/school	
1	The identity of the education/school unit exists and is written clearly.
Subject identity	
2	Subject identities exist and are written.
Class/education level	
3	Classes are written clearly and according to the level of education
Main competencies	
4	There are four main competencies for spiritual, social, knowledge, and skills competencies.
5	The main competencies are written.
Basic competencies	
6	Basic competencies are written clearly and following the subjects being taught
7	There are a pair of basic competencies that meet the demands of the main competencies of the knowledge dimension and skills dimension.
8	Basic competencies according to the abilities of students.
Indicator	
9	Indicators following the objectives to achieve basic competencies.
10	Indicators are following the cognitive and psychomotor levels

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	of students
11	Indicators can be measured as evaluations.
12	Indicators are written clearly.
Subject matter	
13	Relevant and following the subjects being taught
14	Includes all indicators to be achieved
15	The subject matter is written clearly
Learning	
16	Implement a student-centered learning model.
17	Apply a scientific approach.
18	Implementing the 5E learning cycle (Engagement, Exploration, Explanation, Elaboration, and Evaluation).
19	Written clearly.
Assessment	
20	Using test and non-test assessment techniques as an evaluation.
21	Assessment can measure affective, cognitive, and psychomotor aspects.
22	Assessment is objective.
23	The way the assessment is written clearly.
Time Allocation	
24	Following the material taught
25	Following the abilities of students
26	Written clearly, 45 minutes per meeting
Learning Resources	
27	Relevant and following the abilities of students
28	Able to achieve the demands of the syllabus indicators
29	Covers all the material taught
30	Learning resources and references are written

Table 3 shows the validation instrument of the robot transporter learning plan. This validation instrument consists of eight constructs such as lesson plan identity, indicator formulation, formulation of learning objectives, learning methods and scenarios, media and learning tools, learning materials and learning resources, authentic assessment, dan sentences, and grammar. The number of indicators for all constructs is 31 items

Table 3. Validation Instrument of Robot Transporter Lesson Plan

No.	Assessment Indicators
Lesson plan identity	
1	There are educational units, classes, semesters, expertise programs, subjects, or subject / sub-theme themes, number of teaching in the classroom.
Indicator Formulation	
2	The suitability with basic competencies.
3	The suitability of the use of operational verbs with the competence being measured.
4	The suitability with the characteristics of students.
5	The suitability of the formula with the measured aspects.
6	The suitability of the formulation with aspects of knowledge and skills.
Formulation of Learning Objectives	
7	The learning objectives are in line with the basic competencies and core competencies in the syllabus.
8	Demanding students to high order thinking.
9	The objectives refer to the competency achievement indicators.
10	Learning objectives contain aspects of ABCD (Audience, Behavior, Conditions, and Degree).
Learning Methods and Scenarios	
11	Conformity with learning objectives.
12	Apply a learning model and a student-centered learning approach.
13	Learning activities include all indicators of competency achievement.
14	There are details of the activities of learners such as observing, asking, gathering information, associating, and communicating.
15	Learning activities have an introduction, a subject matter, and a closing.
16	Suitability of time allocation for preliminary activities, subject matter activities, and closing activities with material coverage.
Media and learning tools	
17	Conformity with learning objectives and indicators.
18	Conformity with student's characteristics.
19	Relevant and communicative.
20	Conformity with the characteristics of students
Learning materials and learning resources	
21	Relevant and following learning objectives.
22	Includes all indicators to be achieved.
23	Following the abilities of students
24	The teaching material description is sequential.
Authentic assessment	
25	Conformity of forms, techniques, and instruments with competency achievement indicators.
26	The suitability of forms, techniques, and instruments of competency assessment of attitudes, knowledge, and skills.
27	There is an answer key for the assessment and an assessment rubric.
28	Divergently and train students to high order thinking.
Sentences and grammar	
29	Easy to understand.
30	No contain a double meaning
31	Sentences and grammar are according to general guidelines for Indonesian spelling.

Table 4 shows the validation instrument of robot transporter's students' worksheets. This validation instrument consists of six constructs, namely student worksheet identity, indicator formulation, formulation of learning objectives, instruction procedure, main aspects of student worksheets, and sentences and grammar. The number of indicators for all constructs is 25 items

Table 4. Validation Instrument of Robot Transporter Students Worksheet

No.	Assessment Indicators
Student Worksheet Identity	
1	There are: educational units, classes, semesters, expertise programs, subjects or subject / sub-theme themes, number of teaching in the classroom
Indicator Formulation	
2	The suitability with basic competencies.
3	The suitability of the use of operational verbs with the

competence being measured.
4 The suitability with the characteristics of students.
5 The suitability of the formula with the measured aspects.
6 The suitability of the formulation with aspects of knowledge and skills.

Formulation of Learning Objectives

7 The learning objectives are in line with the basic competencies and core competencies in the syllabus.
8 Demanding students to high order thinking.
9 The objectives refer to the competency achievement indicators.
10 Learning objectives contain aspects of ABCD (Audience, Behavior, Conditions, and Degree).

Instruction Procedure

11 Suitability of experimental design.
12 The experimental design presented is clear and easy to understand.
13 The suitability of the stages of planning the experiment with the development of students' knowledge.
14 The stages of planning experiments in the worksheets can help improve student learning abilities.

Main Aspects of Student Worksheets

15 The correctness of the content/material.
16 Suitability of the task with the order of the material.
17 Provide a role to encourage students to find concepts/procedures independently.
18 Feasibility as teaching material.
19 The availability of cognitive and psychomotor worksheets.
20 The availability of an answer key for cognitive worksheets and answer keys for psychomotor worksheets.
21 The availability of tools and materials needed for practical materials.

Sentences and grammar

22 Suitability of sentences with students' level of thinking.
23 The simplicity of sentence structure.
24 No contain a double meaning
25 Sentences and grammar are according to general guidelines for Indonesian spelling.

Table 5 shows the validation instrument of student response. This validation instrument consists of three constructs, namely language, writing format and systematics, and content quality. The numbers of indicator for each construct are as follow: language with six indicators, writing format and systematics with six indicators, and content quality with three indicators. The number of indicators for all constructs is 15 items.

Table 5. Validation Instrument of Student Response

No.	Assessment Indicators
	Language
1.	Readability
2.	Grammatical correctness
3.	The accuracy of the sentence structure
4.	Use of language effectively and efficiently
5.	The language used is communicative
6.	The suitability of grammar with the age of the student
	Writing Format and Systematics
1.	Clarity of writing in instructions for filling student responses
2.	Clarity of writing in the indicators of student opinions on the components asked in the student response questionnaire
3.	Clarity of writing in the novelty indicator for the components being asked in the student response questionnaire
4.	Clarity of writing in the indicator of the ease with which students understand the components being asked in the student response questionnaire
5.	Clarity of writing in the indicators of student interest in the components being asked in the student response questionnaire
6.	The clarity of writing in the activity indicators carried out by the lecturer/teacher is related to the components asked in the student response questionnaire
	Content Quality
1.	The correctness and appropriateness of the contents of the description of the statements submitted in the student response questionnaire
2.	The feasibility of a student response questionnaire as a learning tool
3.	The suitability of the assessment criteria with the description of the statements submitted in the student response questionnaire

Validation of robot transporter learning media was carried out by three experts: two lecturers from a State University of Surabaya, and one teacher from SMK Al Kholiliyah. The validator's assessment of the robot transporter learning media refers to the indicators on the validation sheet with the following assessment criteria (Akbar, 2013): 1 = not valid; 2= less valid; 3 = quite valid; 4= valid; and 5= very valid. The products that had been validated then were revised following the advice of expert media.

Quantitative descriptive was used to analyze data from the validation result by quantifying the average score of the validators assessment. This average score is then transformed into the assessment category shown in Table 6. (Riduwan, 2012)

Table 6. Category of instrument

Score	Category
$3.6 \leq P \leq 4$	Very Valid
$2.6 \leq P < 3.6$	Valid
$1.6 \leq P < 2.6$	Less valid
$1 \leq P < 1.6$	Not valid

RESULTS AND DISCUSSION

Finding

Robot transporter validation results

Three experts in the learning material validated this learning material. The purpose of this learning material validation was to know the validity of robot transporter learning media on microcontroller subjects. The Robot transporter validation data were analyzed using descriptive quantitative analysis, carried out by calculating the average value given by the validators.

Table 7 shows that the results of the validation of the robot transporter learning media from the three validators. The rated of the first validator is 3.84, the rated of the second validator is 3.12, and the rated of the third validator is 3.57. The average value from validators is 3.51. This value is valid in the category aspect.

Table 7. Validation Results of Robot Transporter's Learning Media

No.	Experts	Assessment	Category
1	Expert 1	3,84	Very Valid
2	Expert 2	3,12	Valid
3	Expert 3	3,57	Valid
Average		3,51	Valid
Category aspect			Valid

Learning Plan validation results

In this research, the learning plan consists of three parts such as syllabus, lesson plan, and student worksheet. The validation of this material was carried out by three experts in microcontroller learning material.

From the results of Table 8, it can be shown that the syllabus average score is 3.78 and very valid in the category aspect. The lesson plan with an average score is 3.88 and very valid in the category aspect. The student worksheet's average score is 3.89 and very valid in the category aspect.

Table 8. Validations Results of Robot Transporter Learning Plan

No	Experts	Learning Plan		
		Syllabus	Lesson Plan	Student Worksheet
1	Expert 1	3,60	3,85	3,96
2	Expert 2	3,85	3,84	3,85
3	Expert 3	3,88	3,94	3,87
	Average	**3,78**	**3,88**	**3,89**
	Category aspect	**Very Valid**	**Very Valid**	**Very Valid**

Student Response Results

Respondents used to measure students' responses to the implementation of learning media for the transporter robot in the class were students of class XI TEI 1 with a total of 30 respondents. Based on the average score of student respondents, the categorization is as follows (Riduwan, 2003): (1) scale 1 with a range of 0.00 to 1.33, then the category is Disagree; (2) scale 2 with a range of 1.33 to 2.33, the category is Enough; (3) scale 3 with a range of 2.33 to 3.33, then the category is Agree; and (4) scale 4 with a range from 3.33 to 4.00, the category is Strongly Agree. Table 9 shows the results of the student response.

Table 9. Student response results

No	Questions	Average Score	Category
1	The learning media based on the transporter robot is very interesting.	3.33	Strongly Agree
2	The learning media based on the transporter robot is very efficient.	3.23	Agree
3	The learning media based on the transporter robot can encourage learning.	3.30	Agree
4	The learning media based on the transporter robot can encourage imagination.	3.27	Agree
5	The learning media based on the transporter robot can create new things in microcontroller programming subjects by doing practical work.	3.13	Agree
6	The learning media based on the transporter robot can make students active independently in reasoning knowledge.	2.97	Agree
7	The learning media based on the transporter robot can make students active in questioning activities.	2.97	Agree
8	The learning media based on the transporter robot can make students easily understand the basic concept material in microcontroller programming subjects.	3.27	Agree

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9	The learning media based on the transporter robot can make students easily simulate basic concept material in object-oriented programming subjects.	3.13	Agree
10	The learning media based on the transporter robot can make students learn seriously.	2.87	Agree
11	The learning media based on the transporter robot can make students serious in paying attention to the media.	3.27	Agree
12	The learning media based on the transporter robot very effective in helping students understand learning.	3.13	Agree
13	The learning media based on the transporter robot is very potential in understanding learning.	3.28	Agree
14	Students better understand the basic concept material in microcontroller programming subjects with the learning media based on the transporter robot.	3.30	Agree
15	Students prefer to learn basic concept material in microcontroller programming subjects with the learning media based on the transporter robot.	3.40	Strongly Agree
16	Students increase their knowledge in microcontroller programming subjects after using the learning media based on the transporter robot.	3.27	Agree
17	Students increase their skills in microcontroller programming subjects after using the learning media based on the transporter robot.	3.07	Agree
18	Teachers and students are more interactive in microcontroller programming subjects after using the learning media based on the transporter robot.	2.97	Agree
19	Students are more creative after using the learning media based on the transporter robot.	2.67	Agree
20	The learning media based on the transporter robot make students actively ask questions in microcontroller programming subjects.	2.83	Agree
21	The learning media based on the transporter robot allows students to share knowledge with friends.	3.13	Agree
22	The learning media based on the transporter robot allows students to share experiences with friends.	3.17	Agree
23	The learning media based on the transporter robot make students able to answer teacher questions.	3.07	Agree
24	The learning media based on the transporter robot is more interesting to use.	3.23	Agree
25	The learning media based on the transporter robot can make students more enthusiastic in learning.	3.10	Agree
26	The learning media based on the transporter robot can make student learning outcomes in the cognitive domain on basic concept material higher than before.	3.07	Agree
27	The learning media based on the transporter robot can make student learning outcomes in the psychomotor domain on basic concept material higher than before.	3.13	Agree
28	The learning media based on the transporter robot can make students have active discussions between students and teachers.	2.67	Agree
29	The learning media based on the transporter robot can improve student learning outcomes in the cognitive domain on the subject of basic concepts in microcontroller programming subjects.	3.20	Agree
30	The learning media based on the transporter robot can improve student learning outcomes in the psychomotor domain on the subject of basic concepts in microcontroller programming subjects.	3.10	Agree

The results of student response show that from 30 questions for the students there are two responses with the category are Strongly Agree and 28 responses with the category are Agree. This shows that the transporter robot learning media attracts students to use it in microcontroller subjects.

Discussion

The research results show that the validation results of transporter robot learning media are valid. Therefore, this is also supported and in line with the results of the student responses to questions 1-4 and 18-25 related to the attractiveness of the learning

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media after the students used the learning media. The level of student responses to those questions is 'agree'.

This condition is supported by (Deiniatur, 2019) and (Huili, Won, & Breazeal, 2020) stated that new media can also make students enthusiastic in following the teaching and learning process in the classroom. This is also in line with the research conducted by (Haryawan & Salechan, 2017) reveals that the use of Arduino-based microcontroller teaching materials can help students gained their learning motivation for microcontroller subjects.

The experts' validation result for the transporter robot learning plan consisting of the syllabus, lesson plan, and student worksheets is valid. So, during the process of using learning media, students gave good responses to follow the instructions from the teacher based on the syllabus and lesson plan. This is shown by the student's response to answer questions 10-13 of the student response instrument, related to the ease of transfer of knowledge using the transporter robot learning media. The level of student responses to those questions is 'agree'. According to (Apriyus, Rukun, Huda, & Marta, 2020) that the learning media can lead to the interconnection between users and learning media with mutual influence and mutual action and reaction between them in helping to convey learning material. According to (Widodo, Cahyani, Rumondor, & Suhartono, 2017) that learning media in the form of robots can be used to learn basic mathematics in elementary students. Learning with robots also provides entertainment for elementary students, so that mathematics lessons become more interesting for elementary students to learn it.

As mention before that student worksheet is valid. Therefore, students can do and learn learning material of microprocessor throught the student worksheets. This is supported by student responses to questions 26-30 which contain learning material contained in the worksheet. The level of student responses to those questions is 'agree'. The use of robots as learning media is able to help students to understand learning material with significantly results. According to (Saeedeh, Miller, Rastgaar, & Mahmoudian, 2017) the use of robots can be used to learn STEM in pre-college students where learning outcomes show significant results. The results of this study were also in agreement with research by (Akashiba, et al., 2017). It stated that learning applications for collaborative teaching using robots, laptop PCs, sensors, teachers, and students developed with PRINTEPS shown that the implementation of lessons carried out in science classrooms runs well.

CONCLUSION

Regarding the validation results of the robot transporter learning media in the microcontroller subject, the value of the validity of media quality is 3.89 in the very valid category. The value of validity on the learning plan that consists of the syllabus with the score at 3.78, the lesson plan with the score at 3.88, and the student worksheets with the score at 3.89 are categorized as very valid. Besides student responses with category agree. Thus, it can be concluded that robot transporter learning media can be used in learning microprocessor. It can be seen that the development of this media can increase the learning motivation of students majoring in Industrial Electronics Engineering, especially at the Al Kholiliyah Bangkalan Vocational High School.

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Comment [A35]: The references structure is not appropriate, it needs to be improved to obtain better quality. You have to rewritten it

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SUMMARY REVIEW **EDITING**

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