Development Of Computer Media For Interactive Learning Course Pump And Compressors Application In Students Of D3 Mechanical Engineering Program

By Adi Bandono

WORD COUNT 5938
TIME SUBMITTED 05-JAN-2021 06:59AM
PAPER ID 67514360

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

http://ijpsat.ijsht-journals.org
Vol. 24 No. 1 December 2020, pp. 323-336

Development Of Computer Media For Interactive Learning Course Pump And Compressors Application In Students Of D3 Mechanical Engineering Program

Adi Bandono, Okol Sri Suharyo

Indonesian Naval Technology College, STTAL Surabaya Indonesia

Abstract – This research was conducted with a background on the problem of students who have difficulty understanding the pump and compressor application course. This can be seen from the very low student learning outcomes, namely, 60% of the total students have not reached the material standard. Whereas the minimum material mastery standard is 75% of all students. Thus the research output is interactive learning computer media and the research target is that students can understand the subjects of pumps and compressors and can improve student learning outcomes. The method used follows the R n D model. The subjects of this research are students of the D3 Mechanical Engineering study program at the Indonesian Naval Technology College (STTAL) and the research objects to be developed are the pump and compressor application courses. The benefit of this research collaboration is a form of sharing expertise between the curriculum and educational technology majors with STTAL so that it is expected to obtain output results in the form of ensuring the quality of pump and compressor application courses in students of the STTAL Mechanical Engineering D3 study program in the form of interactive learning media on pump and compressor application courses.

Keywords – Computer Media, Interactive Learning, Pump, and Compressor Subject.

I. INTRODUCTION

Learning is a stage of change in all individual behavior that is relatively sedentary as a result of experience and interaction with an environment that involves cognitive (Nursalim, 2007). If it is related to the role of cognitive aspects for learning activities, this is not sufficient and less representative in meeting learning needs comprehensively because the learning process also requires the acquisition of non-cognitive skill values. However, generally, a group of people who work with the formal education teaching system thinks that these non-cognitive skills are difficult to achieve and detect because visible behaviors and movements can be assumed to arise as a result of being bound by rules including learning discipline, study time, place of study, and other norms.

Each student not only learns at different speeds but also processes information in different ways. This method of processing information is known as a learning style. Learning style is a combination of absorbing, organizing, and processing information. There are three types of learning styles based on the modalities used by individuals in processing information, namely auditory learning styles, visual learning styles, and kinesthetic learning styles. Even though all students are required to balance their understanding with one material delivery with limited time conditions. From such differences in student learning styles, a learning medium is needed that can help students understand the material according to the level of their respective learning styles.

The selection of learning media that is tailored to the student's learning style and the characteristics of the material is expected to increase students' full mastery of certain material as a whole as evidenced by the assessment of student learning outcomes based

Corresponding Author: Okol Sri Suharyo

on the minimum completeness standards that have been set on the material. The results of this assessment and evaluation are feedback to find out to what extent the teaching and learning process that has been implemented can run well (Bandono, 2020).

The use of learning media in the learning process is an inseparable part. Because the existence of a media can overcome the limitations of experience that students have. Each student's experience is different, depending on the factors that determine the richness of student experience, such as the availability of books, and so on. Learning media can overcome these differences. If students cannot possibly be brought to the direct object being studied, then the object is brought to the student directly.

Interactive learning computer media is an integral part of the learning system components. Together with other learning components, learning media are used to convey messages to students so that learning objectives can be achieved as expected. Arif Sadiman defines the meaning of media as anything that can be used to transmit messages from the sender to the recipient of the message so that it can stimulate students' thoughts, feelings, attention, and interests in such a way that the learning process occurs (Sadiman, 2013).

Pump and compressor application courses are one of the courses that must be taken by students of the STTAL Mechanical Engineering D3 study program. There are several competencies that students must master in this course. Seeing the condition of the pump and compressor application lecture in its implementation, most students often have difficulty understanding the material. This can be seen from the low student learning outcomes. Whereas the standard of mastery of the material is determined by 75% of students to achieve the KKM. However, in reality, the average student learning outcomes are only about 40% of the total number of students who can achieve the specified KKM. From the results of the initial study, it appears that the absence of adequate interactive learning media that can be studied independently by students is one of the causes (Bastari, 2020).

From the results of the discussion, it turns out that the course instructor has never provided learning media specifically on the pump and compressor application course. There is only a package of instructions. If the solution is not sought, it will have a negative impact on the quality of student learning.

From the facts that have been described, the researcher feels the need to develop interactive learning media that can be studied independently by students outside lecture hours that are following the characteristics of the material and student characteristics. Problems that will arise in the process of media development are what media are the most practical to package, implement, and update learning and training programs (Anderson in Sadiman, 2013).

From this opinion, it seems that a media developer must understand the characteristics of the media, the characteristics of the material, and the characteristics of the target so that the media being developed can be used to improve the quality of student learning.

From the needs analysis that has been carried out, it can be decided that the development of interactive learning computer media in the pump and compressor application course is necessary.

II. MATERIALS AND METHODS

Development Research

According to Rusijono and Mustaji (2008) that "Development is an activity that produces designs or products that can be used to solve actual problems". According to Seels & Richey (Bambang, 2008) that "the development area includes the development of print technology, audiovisual technology, computer-based technology, and integrated technology". Meanwhile, Twelker et al, in Atwi (1997) define that development is a systematic way to identify, develop, and evaluate a set of learning materials and strategies to achieve learning objectives.

Learning Media

a. Definition

The word media comes from Latin and is the plural form of the word medium which means intermediary or introduction (Sadiman, 2013). Learning media according to Schramm (1977) is a messenger technology that can be used for learning purposes. According to Briggs (1977), learning media is a physical means of conveying content/material.

b. Media Selection Criteria

Several general criteria need to be considered in media selection. Media that is not following environmental conditions and student characteristics cannot be applied in learning, if it is still used, maybe the learning objectives cannot be achieved optimally. According to Susilana (2007), the criteria for selecting learning media are formulated in one-word action, namely an acronym for access, cost, technology, interactivity, organization, and novelty.

c. Learning Media Functions

Learning media has a very strategic function in learning. There is often a phenomenon where students do not understand the subject matter delivered by military teachers because of the absence or lack of optimal empowerment of instructional media in the teaching and learning process. According to Daryanto (2011), the use of computer media in learning activities has cognitive functions, psychomotor functions, and affective functions.

d. Benefits of Learning Media

According to Sudjana and Rivai in Arsyad (2009), the benefits of learning media are learning will attract more student attention so that it can foster learning motivation; learning materials will have a clearer meaning so that it can be easily understood by students and enable them to master and achieve learning objectives; Teaching methods will be more varied, not solely verbal communication through words spoken by military teachers so that students do not get bored and military teachers do not run out of energy, especially if military teachers teach every class hour; students can do more learning activities because they do not only listen to military teacher descriptions, but also other activities such as observing, doing, and demonstrating, and so on.

e. Media Feasibility in Learning

A learning media that will be used in the learning process needs to be tested for its feasibility to find out whether the media is appropriate to be used as a learning medium and can achieve learning objectives well or not (Bandono, 2020).

f. Media Evaluation Variables

The media evaluation variable is the size/measure that determines the success of a media program (Arthana, 2005). Several variables that can be used to evaluate the media include: attractiveness; a comprehensive understanding (comprehension); credibility; identification (identification); message relevancy / importance; intention / motivation; age appropriateness; perception of characters; appropriateness of design; demographic balance; side effect / unanticipated outcomes; value / hidden curriculum; do-ability; content-accuracy; memorability; effectiveness; capacity of elicit active participation; learning; Technical standard; and attention

g. Media Evaluation Instruments

Media evaluation is carried out to obtain information as a basis for improvement or enhancement of the quality of the media being developed. According to Arthana (2005), there are several instruments used in conducting formative evaluations, including:

1) Learning outcomes test (which asks aspects of program content/material), to gather information on whether or not the level of change in target knowledge, abilities, and attitudes after interacting with the instructional media was tried.
2) Questionnaires and interview guides, to gather feedback on the quality of the presentation and the difficulties it causes.
3) Interview guidelines, to gather information about the technical quality of the program.

4) Observation sheet, to gather information about the quality of techniques and target responses during and or after interacting with media programs.

Interactive Learning Computer Media

a. Understanding Interactive Learning Computer Media

Anderson (1994) argues that interactive learning computer media is the use of computers directly with students to convey lesson content, provide exercises, and test teaching and learning progress. Interactive learning computer media are ways to produce or distribute using sources based on the microprocessor (Seels, 1994: 24). Meanwhile, according to Rusman (2013), interactive learning computer media is a form of presenting learning materials and expertise or skills in small units, so that it is easy for students to learn and understand.

b. Characteristics of interactive learning computer media

According to Seels (1994) states that interactive learning computer media has the following characteristics:

1) Can be used randomly or not sequentially or linearly.
2) Concepts are presented in an abstract style with words, symbols, and graphics.
3) Can be used according to the wishes of the students and in the way the military teacher planned.
4) The material combines words and images from media sources.

c. Model of interactive learning computer media presentation format

According to Rusman (2013), there are several formats for presenting interactive learning computer media, when viewed from the learning situation, namely as follows: drills model; simulation model; game model; tutorial model. In this study, using the tutorial model because the tutorial model aims to assist students to achieve optimal learning outcomes as expected.

d. The pattern of using interactive learning computer media

According to Morris's opinion expressed in AECT (1977: 108), there are several basic patterns of learning. This learning pattern includes the use of a complete instructional system by placing the media as a dominant role in which military teachers are not directly involved but cannot replace military teachers in teaching human values because the media are still inanimate objects.

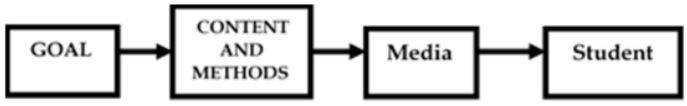

Figure 1. Media Learning Pattern

The pattern of using interactive learning computer media that the researcher uses is the media learning pattern because this pattern is following the initial goal of developing this media, which is to make students learn independently using media that has been developed which the final result of independent learning can improve student learning outcomes.

e. The steps of implementing interactive learning computer media

1) Preparation of military teachers: in this step military teachers set goals to be achieved through interactive learning computer media concerning the material to be explained.

2) Class preparation: this step is not only preparing equipment such as computers, laptops, LCD projectors, and preparing classrooms, but also preparing students in terms of assignments, for example, to be able to follow, take notes, analyze, criticize, and so on.

3) Presentation: at this stage, the presentation of interactive learning computer media is adjusted to its characteristics.

4) Follow-up steps and applications: after the presentation there needs to be learning activities as a follow-up, for example, discussions, reports, and other assignments as evaluation in the learning process.

Pump and compressor Applications course

The description of this course is an explanation of pumps and compressors and applies the function and purpose as well as the role of pumps and compressors in carrying out tasks on the Ships of the Republic of Indonesia. The competency standard is that students can understand and understand about pumps and compressors and apply the functions and purposes as well as the role of pumps and compressors in the implementation of tasks of the Republic of Indonesia Ships (Sutrisno, 2020).

Table 1. Basic competencies and success indicators for the Pump and Compressor Application course

Kompetensi Dasar	Indikator
Able to explain the definition, classification, types, and working principles of pumps and compressors	Be able to explain: a. Definition b. Pump Classification c. Types and working principles d. Dynamic Pump
Able to explain basic equations and work performance	Be able to explain: a. The basic equation for the ideal fluid energy b. Real fluid energy equation c. Pump performance d. NPSH
Be able to explain the basic size of the centrifugal pump	Be able to explain: a. Specific Loop b. Head c. NPSH d. Head generated by the Centrifugal Pump e. Capacity f. Power g. Balancing Propeller h. Pump losses
	Be able to explain: a. Compressor: 1) Compressor Classification 2) Compressor mode interface 3) Dynamic Compressor Be able to explain: b. Compressor Base Size: 1) Air Pressure 2) Compression Process 3) Temperature Change

	4) Volumetric efficiency 5) Compressor Power Calculation
Be able to explain the basic size of the compressor	Be able to explain: a. Determination of Compressor Specifications b. Compressor selection requirements c. Capacity d. Performance e. Drive type and power transmission

Research methods.

The research method in achieving the goal requires a series of supporting components related to the development of learning media in the STTAL mechanical engineering D3 study program as follows:

1. Object of research

The research object being developed is the pump and compressor application course.

2. Subject

The research subjects as implementing researchers were the D3 Mechanical Engineering study program in collaboration with the Unesa FIP educational technology study program.

3. Research focus

To obtain the output, the research was focused on developing interactive learning media for the pump and compressor application course.

4. Development model

The development model used by researchers to develop this Interactive Learning Computer Media is the R n D model from Sugiyono (2013).

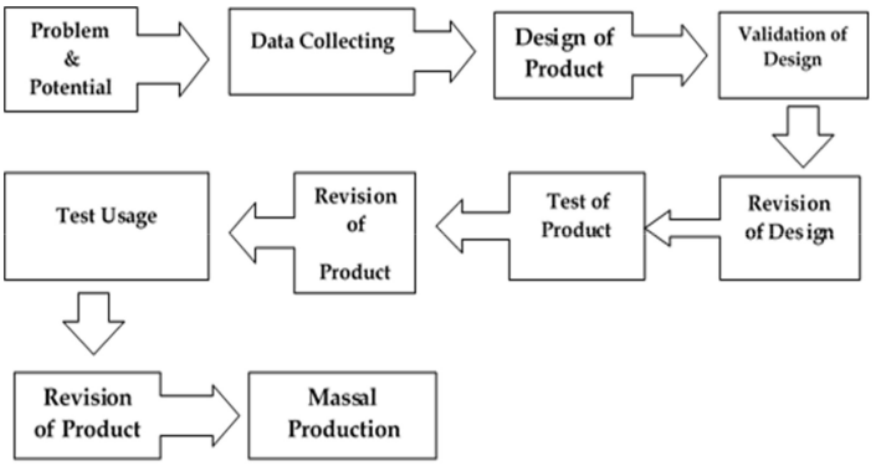

Figure 2. Model Research & Development (R n D) Borg and Gall (1983) In Sugiyono (2013).

Research Design

The research design used pre-test and post-test true experimental design. The results of the data were analyzed and compared before experimenting (pre-test) and after experimenting (post-test).

Group	Pre-test	Treatment	Pos-test
Experiment	O_1	X	O_2
Control	O_3		O_4

Information:
O_1 & O_3 = Pre-test experimental and control groups to determine the initial ability
O_2 = test given to the experimental group after using interactive learning computer media
O_4 = test given to the control group that does not use interactive learning computer media
X = Treatment. The experimental group was given treatment, namely learning using interactive learning computer media, while the control group did not use interactive learning computer media. The effect of learning with interactive learning computer media is O_2 - O_4 (Sugiyono, 2013)

Type of data

The types of data used in this development research include qualitative data and quantitative data. Qualitative data is obtained from the input, responses, suggestions, and or criticism from material experts and media experts. Quantitative data were obtained from the results of material expert trials, media experts, one-on-one trials, small group trials, and large group trials.

Data collection technique

The data collection instruments used by researchers were as follows: structured and unstructured interviews; open questionnaire and closed questionnaires; participant observation; and documentation.

Data analysis technique

The data that has been collected in this development research is interactive learning computer media that refers to the data collection method and experimental design.

a. Content analysis

This analysis was carried out on the results of trials with media experts and military teacher assessments. Qualitative data obtained in the form of responses, suggestions, and improvements. From these data were analyzed as material for revising interactive learning computer media.

b. Descriptive analysis of percentages:

The questionnaire instrument was processed using a Likert scale formula. Data about the quality of interactive learning computer media obtained from students as the subject of the trial with a questionnaire instrument were processed using the Likert scale formula as follows:

$$PSA = \frac{\sum \text{Alternative answers were selected for each aspect}}{\sum \text{ of alternative answers to ideal every aspect}} \text{ x } 100\ \%$$

According to Riduwan (2011) based on the results of this analysis, it can be seen that the feasibility of the media and the opinions of students who have used interactive learning computer media developed are as follows:

Table 2. Likert Scale Criteria

Percentage (%)	Criteria
0 – 20	Not very good
21 – 40	Not good
41 – 60	Moderate
61 – 80	Good
81 – 100	Very well

Test Data

The test data obtained from this development is to use an interval scale, so to find out how to improve learning outcomes using the t-test statistical technique formula, according to Arikunto (2010) the formula is as follows:

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}}$$

Md : The mean difference between pre-test and post-test
$\sum x^2 d$: The sum of the squares of the deviation
N : Subject of sampling

III. Result And Discussion

Preparation and Development

In the preparation stage of this development, steps should be taken following the R&D (Research & Development) development model of Sugiyono (2013). The stages of preparation are as follows:

a. Potentials and Problems

From the results of the preliminary studies that have been conducted, it was found that there are several competencies that students must master in this course. Seeing the condition of the pump and compressor application lecture in its implementation, most students often have difficulty understanding the material. This can be seen from the low student learning outcomes. Whereas the standard of mastery of the material is determined by 75% of students to achieve the KKM. However, in reality, the average student learning outcomes are only about 40% of the total number of students who can achieve the specified KKM. From the results of the initial study, it appears that the absence of adequate interactive learning media that can be studied independently by students is one of the causes.

b. Data collection

After carrying out the potential and problem stages through direct observation and documentation, the next stage is data collection by multiplying literature studies starting from basic competencies and indicators.

Implementation of Development

The next stage after preparation is the development implementation stage, which consists of the product design stage and design validation to produce a prototype interactive learning computer media carried out in the FIP Unesa educational technology study program.

a. Product Design

At the stage of product design, interactive learning computer media uses 3 designs, namely material product design, interactive learning computer media product design, and interactive learning computer media CD design along with accompanying materials and instructional packages.

b. Product design material

At this stage, the activities are gathering information or material from various sources including military teachers, instruction packages, and the internet. Consultation with military teachers is carried out at this stage regarding the material to be developed in interactive learning computer media.

c. Interactive learning computer media product design

The initial stages of this process are:

Flowchart Design

This stage is an activity that aims to explain the workings of interactive learning computer media that will be developed, making it easier for students to understand the interactive learning computer media.

Create Storyboard Format

The form of the storyboard script used in developing this interactive learning computer media script can be described as following

Table 3. Storyboard format for interactive learning computer media

No	Visual	Audio
...	...	...

Information:

(1) Number is the number of images on the storyboard

(2) Visual is an explanation of images in interactive learning computer media

(3) Audio is the voice of the narrator in explaining the material for developing interactive learning computer media

In the next step, after creating a storyboard, the researcher goes on to concrete the storyboard into interactive learning computer media. Product design interactive computer learning media CD, accompanying materials, and instructional packages. At this stage, the developer makes a CD cover design for interactive learning computer media. The accompanying material is a guidebook on program identification, usage procedures, instructions, media care, syllabus, and lesson plans for military teachers and students.

Design validation

Design validation is a process for assessing product design to know the weaknesses and strengths of interactive learning computer media products.

Material expert design validation I

The value of the interactive learning computer media program based on media expert II is 81.8%, this percentage indicates that interactive learning computer media is in the Very Good category.

Material expert design validation II

The value of the interactive learning computer media program based on media expert II is 90.9%, this percentage indicates that interactive learning computer media is in the Very Good category.

Media expert design validation I

The value of the interactive learning computer media program based on media expert II is 100%, this percentage indicates that interactive learning computer media is in the Very Good category.

Media expert design validation II

The value of the interactive learning computer media program based on media expert II is 86.7%, this percentage shows that interactive learning computer media is in the Very Good category.

Design Revision

The next stage of design revision. After a review of the material and media experts, the weaknesses can be identified. These weaknesses will then be reduced by revising and improving the product. Based on the results of quantitative analysis, each interactive learning media assessment instrument showed good results. The average result of each variable shows that the minimum value is in a good category, so there is no revision made by the researcher.

Product Trial

Individual Trial

Individual trials carried out on targets or users of interactive learning computer media. Sampling in the one-on-one trial was taken from three students. The individual trial stage was carried out on 3 students. The value of the interactive learning computer media program based on individual trials is 89.7%, this percentage shows that interactive learning computer media is in the Very Good category.

Small-Group Trial

After revising the individual trials, small group trials were then carried the small group trial stage was carried out with 10 students. Based on the results of suggestions and responses in the form of data analysis in the form of a percentage value from a small group to 10 students is 85.3%, this percentage shows that interactive learning computer media is included in the Very Good category.

Revisions in Individual and Group Trials

After conducting individual, small group, and large group trials, the results of the average analysis of each variable indicate that interactive learning computer media does not need to be revised so that this media has become the final result or the final project of developing interactive learning computer media.

Trial Use

The next step is to do a large group trial, the last trial is a large group trial, namely as a media user or media user. The users of this media are the entire class population. Based on large group trials (field trials), the value of interactive learning computer media programs based large group trials is 91.3%, this percentage shows that interactive learning computer media is in the Very Good category.

Test Result Data Analysis

Calculation of test results

Analysis of test data aims to determine the effectiveness of using interactive learning media in the teaching and learning process. The research pattern used 2 groups, namely the control group whose learning used conventional methods, and the experimental group whose learning used interactive learning computer media. After completing the experimental trial, the results of the two groups.

The pre-test post-test trial design uses the True Experimental Design in the form of the Pre-test Post-test Control Group Design. The data that has been collected in this study are the Pre-test Post-test as follows:

Table 4. Pre-Test and Post-Test Results of the Control and Experimental Groups

Subject	Control Group				Experimental Group			
	Pre Test (X1)	Post test (X2)	Different (X)	X2	Pre Test (X1)	Post test (X2)	Different (X)	X2
1	50	70	20	400	70	90	20	400
2	40	60	20	400	60	80	20	400
3	65	80	15	225	55	70	15	225
4	40	70	30	900	70	80	10	100
5	35	55	20	400	75	90	15	225
6	50	60	10	100	50	70	20	400
7	45	70	25	625	85	95	10	100
8	40	60	20	400	70	80	10	100
9	35	65	30	900	50	70	20	400
10	40	55	15	225	70	80	10	100
11	50	70	20	400	65	70	5	25
12	30	75	45	2025	50	80	30	900
13	60	80	20	400	55	70	15	225
14	55	90	35	1225	80	100	20	400
15	40	90	50	2500	70	90	20	400
16	40	80	40	1600	65	85	20	400
17	50	85	35	1225	60	80	20	400
18	70	90	20	400	70	95	25	625
19	35	80	45	2025	50	80	30	900
20	40	100	60	3600	70	100	30	900
21	50	80	30	900	50	80	30	900
22	65	80	15	225	50	85	35	1225
23	30	100	70	4900	70	100	30	900
Amount	1700	2745	1045	37375	2255	2950	695	15525

From the data Table 4, then analyzed into the following formula:

$$M_x = \frac{\sum X}{N} = \frac{1045}{36} = 29{,}03$$

$$\sum x^2 = \sum X^2 - \frac{(\sum X)^2}{N}$$

$$= 37375 - \frac{(1045)^2}{36}$$

$$= 37375 - \frac{1092025}{36}$$

$$= 37375 - 30334{,}02$$

$$= 7040{,}98$$

$$M_y = \frac{\sum X}{N} = \frac{695}{36} = 19{,}30$$

$$\sum y^2 = \sum Y^2 - \frac{(\sum Y)^2}{N}$$

$$= 15525 - \frac{(695)^2}{36}$$

$$= 15525 - \frac{483025}{36}$$

$$= 15525 - 13417{,}36$$

$$= 2107{,}64$$

$$t = \frac{Mx - My}{\sqrt{\left(\frac{\sum x^2 + \sum y^2}{Nx + Ny}\right)\left(\frac{1}{Nx} + \frac{1}{Nx}\right)}}$$

$$t = \frac{29{,}03 - 19{,}30}{\sqrt{\left(\frac{7040{,}98 + 2107{,}64}{36+36}\right)\left(\frac{1}{36} + \frac{1}{36}\right)}}$$

$$t = \frac{9,73}{\sqrt{\frac{9148,62}{70} \times \frac{2}{36}}}$$

$$t = \frac{9,73}{\sqrt{130,69 \times 0,06}}$$

$$t = \frac{9,73}{\sqrt{7,841}}$$

$$t = \frac{9,73}{2,80}$$

$$t = 3,48$$

$$d.b = (Nx + Ny - 2) = 70$$

Based on the calculation of the results of the pretest and posttest in the control group and the experimental group, the t-count is obtained with a price of to = 3.48, while db = 70 with a significance level of critical price at ts0.05 = 1.66 and at ts0.01 = 2, 38.

1,66 < 2,38< 3,48

So it can be concluded based on the results of these trials it was found that the price to be greater than the price at ts0,05 and ts0,01, namely 1.66 <2.38 <3.48, so this shows that the use of interactive learning computer media in the experimental group can improve the results. student learning.

Revised Trial Use

After conducting a trial use, the results of the analysis show that the interactive learning computer media does not need to be revised so that this interactive learning computer media has become the final result or final project.

Mass Production

After the interactive learning computer media carried out several trials and revisions and got the results that the interactive learning computer media was declared feasible and effective in improving student learning outcomes, so the mass production of interactive learning computer media was carried out.

IV. CONCLUSIONS

After going through the development stages using the R&D (Research & Development) development model starting from development preparation, implementing the development of interactive learning computer media to evaluating or testing interactive learning computer media, the development of interactive learning computer media can be drawn as follows:

a. Interactive learning computer media that has been assessed the feasibility of media to material experts I and II are in the very good category. Media experts I and II are also in the excellent category. In the individual trial, the category value is very good. Small group trials in very good categories. Large group trials with excellent category scores. Based on the results of the data analysis, it can be concluded that this interactive learning computer media is suitable for use in learning activities.

b. Based on data analysis, learning using interactive learning computer media has been shown to significantly improve student learning outcomes. This is evidenced by the post-test scores of the experimental group students (using interactive learning computer media is better than the control group (without using interactive learning computer media).

V. SUGGESTIONS

This development research produces interactive learning computer media, therefore researchers provide suggestions related to the resulting interactive learning computer media.

Utilization Suggestions

In the use of interactive learning computer media that has been developed, it is expected to pay attention to the following:

a. Used as a medium for independent learning. Students can study the material and work on questions without limitation of time and space, can be done anywhere and anytime.

b. Provide maximum learning outcomes through the role of military teachers as facilitators. Military teachers can first explain the stages of using interactive learning computer media to students, and explain which parts students have to go through.

Suggested Product Dissemination (Deployment)

The development of interactive learning computer media is only for students of the D3 Mechanical Engineering STTAL study program. If it is used for other students or the use of the product for a wider scale, needs analysis, environmental analysis, analysis of target characteristics, analysis of the curriculum used, consideration of the time required, consideration of available equipment must be carried out.

Further Development Suggestions

a. The development of interactive learning computer media is not only focused on the D3 Mechanical Engineering study program, STTAL but can be developed in other study programs so that learning can be more varied.

b. Choosing a material that is following the characteristics of the media by selecting only important material that can represent the whole when presented in interactive learning computer media.

ACKNOWLEDGEMENT

The authors greatly acknowledge the support from the **Indonesian Naval Technology College (STTAL) Indonesia** for providing the necessary resources to carry out this research work. The authors are also grateful to the anonymous reviewers and journal editorial board for their many insightful comments, which have significantly improved this article

REFERENCES

[1] Anderson, R.H. 1994. Pemilihan dan Pengembangan Media untuk Pembelajaran. Terjemahan oleh Yusufhadi Miarso dkk. Jakarta: CV. Rajawali

[2] Arikunto, Suharsimi. 2010. Prosedur Penelitian: Suatu Pendekatan Praktik. Jakarta: PT Rineka Cipta.

[3] Arsyad, Azhar. 2013. Media Pembelajaran. Jakarta: PT Raja Grafindo Persada.

[4] Arthana, I Ketut Pegig dan Dewi, Damajanti Kusuma. 2005. Evaluasi Media Pembelajaran. Surabaya: bahan ajar tidak diterbitkan.

[5] Association for Educational Communication and Technology. 1977. The Definition of Educational Technology. Washington: AECT.

[6] Bandono, A., Bastari, A., & Suharyo, O. S. (2020). Effectiveness Naval Collaboration Flexible Learning (NCFL) Model in Increasing Learning Outcomes The Indonesian Naval Technology College. International Journal of Progressive Sciences and Technologies, 23(2), 334-342.

[7] Bandono, A., Rahman, A., & Suharyo, O. (2020). The Application Model of Naval Collaboration Flexible Learning (NCFL) in the Indonesian Naval Technology College: A Case Study. International Journal of Progressive Sciences and Technologies, 23(2), 498-505.

[8] Bastari, A., & Suharyo, O. S. (2020). Analysis of The Implementation of Occupational Safety Program Efforts to Improve Work Productivity With Fault Tree Analysis Approach. *International Journal of Progressive Sciences and Technologies*, *23*(2), 628-633.

[9] B. Seels, Barbara dan C. Richey, Rita. 1994. Teknologi Pembelajaran: Definisi dan Kawasannya. Jakarta: Universitas Negeri Jakarta.

[10] Darmawan, Deni. 2012. Teknologi Pembelajaran. Bandung: PT. Remaja Rosdakarya

[11] Daryanto. 2011. Media Pembelajaran. Bandung: Satu Nusa Studio.

[12] Indriana, Dina. 2011. Ragam Alat Bantu Media Pengajaran: Mengenal, Merancang, dan Mempraktikkannya. Jogjakarta: Diva Press.

[13] Kerlinger, Fred N. 2006. Asas-Asas Penelitian Behavioral. Terjemahan Landung R. Simatupang. Yogyakarta: Gadjah Mada University Press.

[14] Nursalim, M., Satiningsih, dkk. 2007. Psikologi Pendidikan. Surabaya: Unesa University Press.

[15] Rahayu, Iin T., & Ardani T. A. 2004. Observasi & Wawancara. Malang: Bayumedia.

[16] Riduwan. 2011. Dasar-Dasar Statistika. Bandung: Alfa Beta.

[17] Rusijono dan Mustaji. 2008. Penelitian Teknologi Pembelajaran. Surabaya: Unesa University Press

[18] Rusman, dkk. 2013. Pembelajaran Berbasis Teknologi Informasi dan Komunikasi: Pengembangan Profesionalitas Guru. Jakarta: PT Raja Grafindo Persada.

[19] Sadiman, Arief S. 2013. Media Pendidikan. Jakarta: Rajawali Pers.

[20] Sugiyono. 2013. Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta.

[21] Susilana, Rudi dan Riyana, Cepi. 2008. Media Pembelajaran: Hakikat, Pengembangan, Pemanfaatan dan Penilaian. Bandung: CV. Wacana Prima.

[22] Sutrisno, S., & Suharyo, O. S. (2020). Air System Analysis in Engineering Room of the Vessel Ship. *International Journal of Progressive Sciences and Technologies*, *23*(2), 506-511.

[23] Warsita, Bambang. 2008. Teknologi Pembelajaran. Jakarta: Rineka Cipta.

Development Of Computer Media For Interactive Learning Course Pump And Compressors Application In Students Of D3 Mechanical Engineering Program

ORIGINALITY REPORT

14%

SIMILARITY INDEX

PRIMARY SOURCES

1	Winarto Winarto, Ahmad Syahid, Fatimah Saguni. "Effectiveness the Use of Audio Visual Media in Teaching Islamic Religious Education", INTERNATIONAL JOURNAL OF CONTEMPORARY ISLAMIC EDUCATION, 2020 Crossref	97 words — 2%
2	Cahyo Budi Utomo, Junaidi Fery Lusianto. "Historical Pocket Book Application As an Alternative Media of History Learning", KnE Social Sciences, 2019 Crossref	89 words — 1%
3	Svetlana Sarantseva, Alexander Schwarzm. "Chapter 12 Modeling Amyloid Diseases in Fruit Fly Drosophila Melanogaster", IntechOpen, 2011 Crossref	78 words — 1%
4	Sulistiyani Sulistiyani, Nur Hidayat, Nuurus Sa'aadah. "Online Video Effect as a Learning Media in Improving Speaking Ability English Class X Students of Hang Tuah 4 High School Surabaya Study Year 2017/2018", Kontribusia (Research Dissemination for Community Development), 2018 Crossref	64 words — 1%
5	"The Application of CBA and SUG Model for Improving The Quality of Indonesian Navy Human Resources", International Journal of Recent Technology and Engineering, 2019 Crossref	58 words — 1%
6	I Ketut Sudarsana, Ayu Ratih Nakayanti, Andy Sapta, Haimah et al. "Technology Application In Education And	51 words — 1%

Learning Process", Journal of Physics: Conference Series, 2019
Crossref

7 Siti Komariah Nurlela, A S Pratiwi, Rahmat Permana, M F Nugraha, B Hendrawan, Mujiarto, Milah Nurkamilah. "Development of kite number learning media help adobe flash cs6 on the concept of place number values in elementary school 2 Singaparna", Journal of Physics: Conference Series, 2020
Crossref
37 words — 1%

8 Hijril Ismail. "THE EFFECTIVE OF USING SQR3 METHOD IN STUDENT'S READING COMPREHENSION", Linguistics and ELT Journal, 2015
Crossref
32 words — 1%

9 Siti Sofiyati. "Development of Video Education with Discipline-Based Material for Elementary School Students", IMTECH: Journal of Instructional, Media Education and Technology, 2020
Crossref
32 words — 1%

10 Mohammad Faizal Amir, Mahardika Darmawan Kusuma Wardana. "PENGEMBANGAN DOMINO PECAHAN BERBASIS OPEN ENDED UNTUK MENINGKATKAN KEMAMPUAN BERPIKIR KREATIF SISWA SD", AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 2017
Crossref
24 words — < 1%

11 Rasmita Rasmita. "Effectiveness of Using English Module Through Implementation Poster Presentation Aided Vlog To Improve Student Learning Outcomes Information of Students Information System at UPI "YPTK" Padang", Linguistics and ELT Journal, 2020
Crossref
21 words — < 1%

12 W Wiana. "Interactive Multimedia-Based Animation: A Study of Effectiveness on Fashion Design Technology Learning", Journal of Physics: Conference Series, 2018
Crossref
21 words — < 1%

13 Kaini Kaini. "PENINGKATAN KETERAMPILAN MENULIS TEKS BERITA MENGGUNAKAN
20 words — < 1%

METODE OBSERVASI LAPANGAN DAN MEDIA BERBASIS TEKNOLOGI", Jurnal Edukasi Khatulistiwa, 2018
Crossref

14 Zul Anwar, Basuki Wibawa, Nurdin Ibrahim. "DEVELOPMENT OF TEACHING MATERIALS FOR SASAK ALUS LANGUAGE AS CULTURAL PRESERVATION AND LEARNING RESOURCES", Humanities & Social Sciences Reviews, 2019 — 19 words — < 1%
Crossref

15 Dwi Amelia Galuh Primasari, Suparmanto Suparmanto, M Imansyah. "INFORMATION AND COMMUNICATION TECHNOLOGY AS MEDIA INNOVATION AND SOURCES OF LEARNING IN SCHOOL", INTERNATIONAL JOURNAL OF EDUCATIONAL REVIEW, 2019 — 19 words — < 1%
Crossref

16 Rahesa Nalendra, Iskandar Wiyokusumo, Ibut Priono Leksono. "THE EFFECT OF LEARNING MODEL LEARNING LEARNING WITH YOUTUBE VERSUS MEDIA FLASH CARD MEDIA AND LEARNING MOTIVATION ON LEARNING OUTCOMES IN ENGLISH", Journal of English Educational Study (JEES), 2020 — 18 words — < 1%
Crossref

17 Guntur Cahyono. "Interactive Media Development of Procedures for Prayer (Tara Shalat) Based on Adobe Flash in Improving the Skills of Madrasah Ibtidaiyah Prayers", MUDARRISA: Jurnal Kajian Pendidikan Islam, 2019 — 17 words — < 1%
Crossref

18 Lari Andres Sanjaya, Agus Setyo Budi, I. Made Astra, Ratna Widayanti Puspa D.. "Renewable energy props development", AIP Publishing, 2019 — 16 words — < 1%
Crossref

19 Reni Ariska Putri, Sri Uchtiawati, Nur Fauziyah, Syaiful Huda. "Development of Interactive Learning Media Flip-Book Using Kvisoft Flipbook Maker Based on Local Culture Arts", INNOVATION RESEARCH JOURNAL, 2020 — 16 words — < 1%
Crossref

20 Syaiful Islam, Hasan Baharun, Chusnul Muali, Moh. Idil Ghufron, Mushfi el Iq Bali, Mualim Wijaya, Ismail Marzuki. "To Boost Students' Motivation and Achievement through Blended Learning", Journal of Physics: Conference Series, 2018
Crossref
16 words — < 1%

21 R Diani, Y Yuberti, S Anggereni, G N Utami, A Iqbal, I Kurniawati. "ECIRR (Elicit, Confront, Identify, Resolve, Reinforce) learning model with the pictorial riddle method: is it effective in reducing physics misconceptions?", Journal of Physics: Conference Series, 2020
Crossref
16 words — < 1%

22 Dwi Fita Heriyawati, Ifit Novita Sari. "Pelatihan Penulisan Penelitian Tindakan Kelas (PTK) pada Guru Sekolah Dasar di Kecamatan Sukun Kota Malang", Amalee: Indonesian Journal of Community Research and Engagement, 2020
Crossref
15 words — < 1%

23 Ani Widiastuti. "Peningkatan Keterampilan Menulis Eksposisi Melalui Penerapan Metode Team Assisted Individualization Pada Siswa SMA Muhammadiyah 2 Cepu Kabupaten Blora", Linguista: Jurnal Ilmiah Bahasa, Sastra, dan Pembelajarannya, 2019
Crossref
11 words — < 1%

24 "Conflicts Identification among Stakeholders in Goal Oriented Requirements Engineering Process", International Journal of Innovative Technology and Exploring Engineering, 2019
Crossref
11 words — < 1%

25 Brash, Marissa. "Safety in Numbers: Overcoming Statistics Anxiety in Undergraduate Nursing Students Through Team-based Learning.", The Johns Hopkins University, 2020
ProQuest
10 words — < 1%

26 Janus S. Liang. "A web-based training framework in automotive electric education", Computer
9 words — < 1%

Applications in Engineering Education, 2009
Crossref

27 I. Kusumawati, Sumarli, Sutopo, S. Kusairi. "Development of multiple representation learning model based on HOTS students in straight motion material", AIP Publishing, 2019 — 9 words — < 1%
Crossref

28 Kunto Imbar Nursetyo, Erry Utomo, Muhammad Azhar Thifal, Ersa Mauliza. "Pendampingan Pengembangan Papan Buletin untuk Guru SD Kecamatan Sukamakmur, Bogor, Jawa Barat", JURNAL PENGABDIAN KEPADA MASYARAKAT, 2020 — 8 words — < 1%
Crossref

29 Linda Aruan, Risnovita Sari, Ahmad Bengar Harahap. "Using Prezi Online Software to Improve Teaching Listening Skill", International Journal of Education and Literacy Studies, 2020 — 8 words — < 1%
Crossref

30 Holding, Emily Z.. "Texting to Increase the Impact of Parenting (TIIP) Program: Examining the Effects of a Texting Supplement on Parent and Child Outcomes in the Incredible Years Preschool Basic Parenting Program.", The University of North Carolina at Chapel Hill, 2020 — 8 words — < 1%
ProQuest

31 Janus S. Liang. "Design and implement a virtual learning architecture for troubleshooting practice of automotive chassis", Computer Applications in Engineering Education, 2009 — 7 words — < 1%
Crossref

32 Rizka Ariani, Ratnawulan. " Analysis of interactive media integrated natural science with energy themes in the life of using integrated types that integrate of learning for the 21 century ", Journal of Physics: Conference Series, 2020 — 7 words — < 1%
Crossref

33 Mansell, Rebecca. "Mandated Reporter Education for Dental

Students at an Academic Medical Center.", The University of Mississippi Medical Center, 2020
ProQuest

6 words — < 1%

EXCLUDE QUOTES	OFF	EXCLUDE MATCHES	OFF
EXCLUDE BIBLIOGRAPHY	OFF		