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(RESEARCH ARTICLE)

Development of computer media for interactive learning on the course of application fluid mechanics in the study program of D3 mechanical engineering

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Abstract

The purpose of this research, in general, is to design and develop interactive learning media in the fluid mechanics' course of applications for D3 mechanical engineering students at the Indonesian Naval Technology College (STTAL) to solve learning problems and improve student competence so that independent students can be formed in the learning process. The specific purpose of this research is to produce an interactive learning media, an alternative learning experience that can be accessed anywhere and anytime so that it can provide a deeper understanding and to assess the process and learning outcomes of the fluid mechanics subject in STTAL mechanical engineering D3 study programs. This research uses the R n D, development model. The process of developing interactive learning computer media is carried out in several stages, starting from identification of potentials and problems, data collection, product design, design validation by material experts and media experts, design revision, and product testing. Data analysis was obtained from the results of filling out the checklist by each expert and student questionnaire. To determine the effectiveness of interactive learning computer media in improving learning outcomes used data analysis using the t-test. The subjects of this research are students of the D3 Mechanical Engineering STTAL study program and the research objects to be developed are fluid mechanics applications. The benefit of this research collaboration is a form of sharing of expertise so that it is expected to obtain output in the form of measuring the quality of the fluid mechanics' course application for students of the STTAL mechanical engineering D3 study program in the form of interactive learning media on learning application fluid mechanics courses.

Keywords: Computer Media; Interactive Learning; Fluid Mechanics Subject

1. Introduction

Education plays an important role in improving human resources in the development of the Nation and State. Education has a moral responsibility in creating quality Human Resources (HR). To improve the quality of education, many reforms and improvements have been carried out which include aspects of quality, relevance, and equity. The development of information technology has an impact on the development of science globally, especially in the world of education. The process of developing information technology runs very fast, but the process of knowledge application, especially in the world of education, still needs a very in-depth study. This is because the character of the subject implementing education in Indonesia is very varied, also influenced by the character of different national cultures.

Indonesian Naval Technology College (STTAL) as one of the implementers of higher education, this is a challenge in developing the potential of education in the academic community as equal or comparable to education at the national and international levels. In facing the era of information technology development, the STTAL mechanical engineering D3 study program needs to conduct a self-evaluation of the results of academic management performance, thus it is necessary to pay attention to curriculum changes as one of the main bases for educational and teaching procedures. One of the research ideas that became the initial foothold was the fluid mechanics' course application in the D3 mechanical

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engineering study program STTAL because with the development of application fluid mechanics course material it is expected that other courses can be lifted in the development system (Bastari, 2020).

As a comparative study in the development of academic potential for research quality, the Research Team for the D3 mechanical engineering study program STTAL as the Implementing Research Team (TPP) conducted a mutually beneficial collaboration (symbiotic mutualism) with the Partner Research Team (TPM), namely the educational technology study program, Faculty of Education, Surabaya State University to solve learning problems (Sutrisno, 2020).

From the results of interviews with military teachers, it shows that: (1) students' learning activeness is still low, this is indicated by the attitude of students who are less enthusiastic during the learning process, (2) students have difficulty mastering abstract concepts, so students find it difficult to understand the material, (3) the existence of limited media and time in the learning process because student learning resources are only obtained from teachers and textbooks, and (4) students cannot achieve the expected competencies. This happens because military teachers have not used innovative media that can attract students' attention to the learning process (Bandono, 2020).

The results of the collaboration in the form of sharing of expertise are expected to obtain output results in the form of measuring the quality of the fluid mechanics' course application of the STTAL mechanical engineering D3 study program by designing and developing interactive learning media in learning fluid mechanics applications according to student characteristics.

Computer-based learning is learning where students can improve their understanding of material using interactive learning computer media. Interactive learning computer media can overcome the characteristics of students' different learning styles including visual (visual learner), auditive (auditory learner), and kinesthetic (tactual learner). Interactive learning computer media includes elements of audio, visual, text, and animation that can stimulate students to learn the material in the learning process and can control the learning speed of students who vary according to their respective abilities. Through this interactive learning computer media, it is expected to produce appropriate and effective media. Feasible in the sense that the designed media can be used according to the needs and characteristics of students. Meanwhile, effective means that it can achieve the expected learning objectives (Bandono, 2020).

2. Material and methods

2.1. Development Research

According to Borg and Gall (2003), development research is research-oriented to develop and validate products used in education. According to Sugiyono (2009), research and development is a research method used to produce certain products and test the effectiveness of these products. According to Sukmadinata (2010), development research is a process or steps to develop a new product or improve an existing product. These products can be objects or hardware (hardware), such as books, modules, learning aids, or software such as computer programs, classroom learning, educational models, and so on.

According to Rusijono and Mustaji (2008) development research is an activity that produces designs or products that can be used to solve actual problems. In this case development activities emphasize the use of theories, concepts, principles, or research findings to solve problems. Development is the process of translating design specifications into physical form. Seels and Richey (1994) describe development as a) the message contained in the content, b) the learning strategy that controls the theory, and c) the embodiment of technology in the form of hardware, software, and learning media materials. Miarso (2010) argues, that when studied empirically, development is a method that is carried out by creating a limited model that is carefully monitored first. This strategy does have a more solid scientific basis because the various components of development are tried, assessed, and refined.

3. Learning Media

3.1. Understanding Learning Media

The Association of Education and Communication Technology / AECT (1979) defines media as all forms and channels for the information transmission process. Besides, according to Heinich et al (1982), the term medium is an intermediary that delivers information between the source and receiver. According to Arief Sadiman (2008), media is anything that can be used to transmit messages from sender to recipient so that it can stimulate students' thoughts, feelings, attention, and interests in such a way that the learning process occurs. Learning media is a tool used to assist

teaching and learning activities and has a function to clarify the meaning or content of the message conveyed so that it can achieve better-formulated learning objectives. (Kustandi & Sutjipto, 2011). According to Hamalik in Musfiqon (2012) defines media is a technique used to more effectively communicate between teachers and students in the education and learning process in schools.

3.1.1. Classification of Learning Media

Technological developments have led to various learning media, based on this background grouping is required. According to Seels and Richey in Arsyad (2011), they classify learning media based on technology, namely:

1) Media produced by printing technology.

2) Media resulting from audiovisual technology.

3) Technology-based media.

4) Media combined with print technology and computers.

3.1.2. Benefits and Uses of Learning media

The use of media in the learning process can directly or indirectly have an impact on the learning process, therefore learning media is expected to improve the quality of student learning. The benefits of learning media according to Sudjana and Riva'i (2007), namely:

1) Learning will attract more students' attention so that it can foster learning motivation.

2) The meaning of the learning material will be clearer so that it can be better understood by students, and allows students to better master the teaching objectives.

3) Students do more learning activities because they do not only listen to teacher descriptions but also other activities such as observing, doing, demonstrating, and others.

4) Teaching methods will be more varied, not merely verbal communication through words spoken by the teacher so that students do not get bored and teachers do not run out of energy, especially if the teacher teaches for every class hour

3.1.3. Media selection

Learning media has various kinds, such as posters, dioramas, computer learning, audio, television, and so on. Media has an important role in the learning process that can help students and teachers in delivering learning material. Although the media has sophisticated technology, the use of media is more based on its function and role in helping the learning process. According to Cecep and Bambang (2011) media selection consists of: the suitability of media types with curriculum materials; affordability in financing; availability of hardware for the use of learning media; availability of learning media on the market; ease of utilizing learning media.

3.1.4. The Importance of Learning Media

In the opinion of Sudjana and Rivai (2007), it explains that the role of the media in the teaching process can be placed as follows: a tool to clarify teaching materials when the teacher delivers lessons. In this case, the media is used by the teacher as a variation of the verbal explanation regarding the teaching materials; a tool to raise or cause problems to be studied further and solved by students in the learning process. At least the teacher can place the media as a source of questions or stimulation of student learning; learning resources for students, meaning that the media contains materials that must be studied by students both individually and in groups.

3.2. Learning Computer Media

3.2.1. Understanding Computer Media Interactive learning

At first, due to the limitations of technology at that time, it was still very simple and lacked in attracting students 'attention and teachers' interest in using it (Rosenberg in Sutopo, 2012). According to Darmawan (2012), interactive learning computer media is a learning program using software, namely computers in which there are subject matter

and are used in the interactive learning process. AECT 1994 (Seels & Richey, 1994) states that interactive learning computer media is a process of producing and delivering materials or materials through microprocessor-based devices, namely computers. According to Arsyad (2011) that interactive learning computer media is a microprocessor-based system for delivering subject matter whose lessons are designed and programmed into the system.

3.2.2. Characteristics of Interactive Learning Computer Media

According to Kustandi & Sutjipto, (2011) interactive learning computer media has the following characteristics: it can be used randomly, non-sequentially, or linearly; can be used based on the wishes of the student or based on the wishes of the designer or developer as planned; ideas are presented in an abstract style with words, symbols, and graphics; the principles of cognitive science for developing this medium; student-oriented learning and involves high student interaction;

3.2.3. The components of interactive learning computer media

According to Sutopo (2012), interactive learning computer media has several elements, namely text, images, animation, audio, video, interactivity, and when used together it will be able to provide clear meaning to those who use it.

3.2.4. Interactive Learning Computer Media Models

In interactive learning computer media, some models or forms can be applied. According to Darmawan (2012), there are 4 models of interactive learning computer media including:

1) Drills

2) Simulation

3) Tutorial

4) Games

3.2.5. Computer Media Interactive Learning Model Tutorial

In interactive computer learning media, the tutorial model is learning using the software in the form of a computer program that contains subject matter and material problems in the learning process. Rusman et al, (2013) suggested the steps for learning interactive learning media tutorial model as follows:

1) Presentation of information, in the form of subject matter that students learn.

2) Questions and responses (Question of responses), namely in the form of practice questions that must be done by students.

3) Judging of responses, namely the computer responds to student performance and answers.

4) Providing feedback about responses, that is, after completion, the program provides feedback. Has been successful or repeat.

5) Repetition (Remediation).

6) Sequencing lesson segment.

Making a flow chart or flow chart of interactive learning computer media tutorial models is done to clarify the flow of activities through the tutorial model. The following is a computer interactive learning flowchart tutorial model:

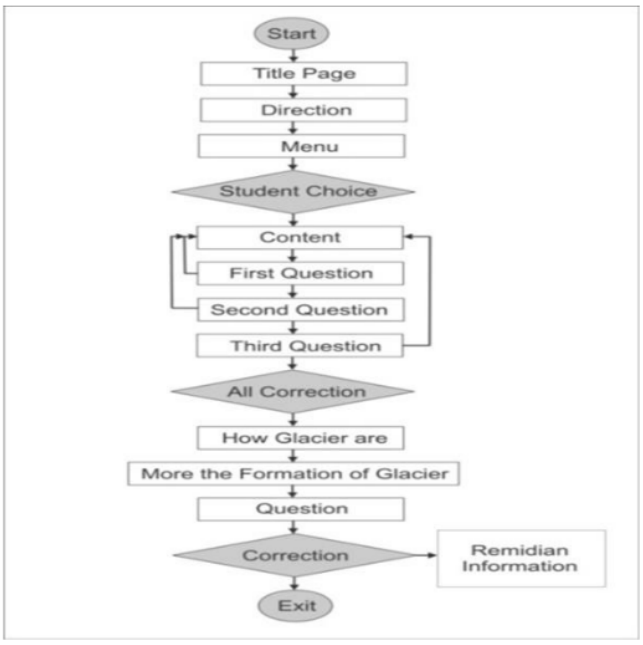

Figure 1 Flowchart Model Tutorial (Rusman et al, 2013)

3.2.6. Strengths and Weaknesses of Interactive Learning Computer Media

nrich, et al in Warsita, (2008) stated several advantages and disadvantages of interactive learning computer media in the learning process.

The advantages of interactive learning computer media, namely:

i. Computers allow students to learn according to their ability and speed in understanding the subject matter presented.
ii. Computers can create an effective learning climate for slow students (slow learner), but also can spur learning effectiveness for students who are faster (fast learner).
iii. Computers can integrate color, music, and graphic animation components that can convey subject matter with a high level of realism.
iv. Computers can be programmed to be able to provide feedback on learning outcomes and provide reinforcement of student learning achievement.
v. With the ability of computers to record learning outcomes of the user (record keeping), computers can be programmed to check and provide suspension of learning outcomes automatically.
vi. The use of computers in the learning process enables students to control their learning activities.
vii. Weaknesses of interactive learning computer media, as follows:
viii. The high cost of procuring and developing computer media, specially designed specifically for learning.
ix. Requires multimedia (computer) equipment.
x. Operational capability is needed, therefore it is necessary to add operating instructions (learning guides).
xi. Only works for things as programmed.
xii. Minimum requirements for processor, graphics card memory, and monitor.

From the explanation above, interactive learning computer media provides advantages that other learning media do not have, namely its interaction ability. From the strengths and weaknesses of learning computer media, it can be used as a benchmark in its development and use as a learning medium.

3.2.7. Supporting Factors for the Success of Interactive Learning Computer Media

Arsyad (2011) argues that several factors support the success of learning with interactive learning computer media, namely: learning must be fun; guide and train students in an informal environment; interactivity; training opportunities must be motivating, appropriate, and provide feedback.

4. Research methods

4.1. Model Development

In developing interactive learning computer media, the researcher chooses the research method of R & D (Research and Development). Research methods and development R & D (Borg and Gall) is a research method used to produce certain products to test the effectiveness and feasibility of these products (in Sugiyono, 2009).

Sugiyono (2009) describes the steps of research and development R&D (Borg and Gall) which include, (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revisions, (6) product trials, (7) product revisions, (8) product trials, (9) product revisions, (10) mass production. The procedural steps in this study were carried out in stages as shown in Figure 2 below:

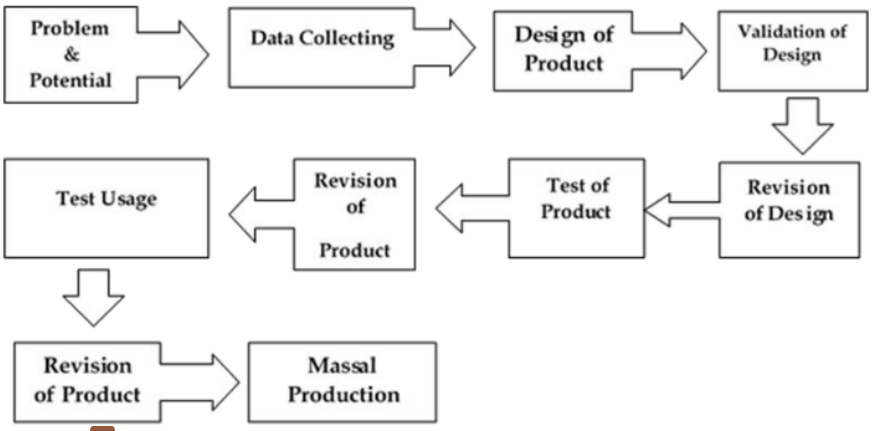

Figure 2 Research and Development (R n D) Model Steps Borg and Gall in Sugiyono (2009)

4.2. 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).

Table 1 Research Design

Group	Pre-test	Treatment	Pos-test
Experimental	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, 2009)

4.3. Research subject

The research subjects as implementing researchers were the D3 Mechanical Engineering study program in collaboration with the Surabaya State University educational technology study program.

4.4. 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.

4.5. 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.

4.6. Data analysis technique

Data analysis is an activity carried out to find and organize data or information that has been obtained during the research. The data or information will be grouped and translated into units for which conclusions will be drawn. (Sugiyono, 2009)

4.6.1. Content Analysis

Content analysis is carried out on the results of product trials to media experts and material experts. Qualitative data obtained in the form of responses, suggestions, and improvements. From the results, the data is then grouped and analyzed for product improvement.

4.6.2. Percentage Descriptive Analysis

This study using data analysis technique namely the PSP calculation technique (percentage of all aspects). The PSA calculation is used as a calculation of the percentage of each aspect of the variables contained in the media being evaluated. The calculation formula is as follows:

PSA calculation technique (Percentage of Each Aspect) with the formula:

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

The media assessment according to Arikunto (2010) is as follows:

80% - 100% = Very good
66% - 79% = Good
40% - 65% = Not good
0% - 39 = Very not good

4.6.3. Test Data

The test data obtained from this development uses an interval scale using the t-test statistical technique formula. The mean test is calculated using the t-test formula as follows:

$$t = \frac{M_x - M_y}{\sqrt{\left(\frac{\sum x^2 + \sum y^2}{N_x + N_y - 2}\right)\left(\frac{1}{N_x} + \frac{1}{N_y}\right)}}$$

M = average value of results per group
N = number of subjects
x = the deviation of each x_2 and x_1 value
y = the deviation of each y_2 and y_1 value
(Arikunto, 2010)

5. Results and discussion

5.1. Development Preparation

Before researching the field to obtain data, the steps that must be done are preparation for development. In preparation for development, research must be following the R&D development model in Sugiyono (2009). The stages of preparation for development are as follows:

5.1.1. Potentials and Problems

In this stage, the researchers conducted observations and interviews with military teachers related to learning problems. Problems and difficulties in the learning process are potential and problems. From the results of interviews with military teachers, it shows that: (1) students' learning activeness is still low, this is indicated by the attitude of students who are less enthusiastic during the learning process, (2) students have difficulty mastering abstract concepts so that students find it difficult to understand the material, (3) there are limitations to the media and time in the learning process because student learning resources are only obtained from teachers and textbooks, and (4) students cannot achieve the expected competencies. This happens because military teachers have not used innovative media that can attract students' attention in the learning process.

5.1.2. Data collection

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

5.2. Implementation of Development

The next stage after preparation is the implementation stage of development. This stage consists of product design and design validation to produce a prototype interactive learning computer media.

5.2.1. Product Design

Material Product Design

At this stage, information or material is collected from various sources, including military teachers, instruction packages, and the internet. Consultations with military teachers were carried out regarding the material to be developed on interactive learning computer media.

Product Design of Interactive Learning Computer Media

5.2.2. Flowchart Design

In this stage, it aims to explain how interactive learning computer media works which are developed procedurally and are arranged systematically, making it easier for users to understand the media.

5.2.3. Creating Storyboard Format

In developing an interactive learning computer media script using the storyboard script format as below:

Table 2 Storyboard format for interactive learning computer media

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

5.3. Development of interactive learning computer media

The next step after creating a storyboard script is to create interactive computer learning media according to the storyboard.

5.4. CD Product Design, Companion Materials, and Instruction Packages

At this stage, the researcher made a CD cover design for interactive learning computer media. The accompanying material is a guidebook or manual containing program identification, usage procedures, instructions for use, media care, syllabus, and lesson plans, as well as making instruction packages.

5.5. Design Validation

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

1) Validation of Material Expert Design I

The value of the interactive learning computer media program based on material expert 1:

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

$$= \frac{5+1+1+3}{10} \text{ x } 100\ \% \ = 100\ \%$$

Based on the above-average results, which is 100%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

2) Validation of Material Expert Design II

The value of the interactive learning computer media program based on material expert II is:

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

$$= \frac{5+1+1+3}{10} \text{ x } 100\ \% = 100\ \%$$

Based on the above-average results, which is 100%, this percentage indicates that the computer learning media according to Arikunto (2010) is in the Very Good category.

3) Validation of Media Expert Design I

The value of the interactive learning computer media program based on media expert II is:

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

$$= \frac{11+2}{13} \text{ x } 100\ \% = 100\ \%$$

Based on the above-average results, which is 100%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

4) Validation of Media Expert Design II

The value of the interactive learning computer media program based on media expert II is:

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

$$= \frac{11+2}{13} \text{ x } 100\ \% = 100\ \%$$

Based on the above-average results, which is 100%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

5.6. Design Revision

From the validation results with material experts and media experts, there are no significant revisions to the interactive learning media developed.

5.7. Product Trial

5.7.1. Individual Trial

Individual trials are carried out after the interactive learning computer media product has been revised based on the criticism, suggestions, and input that have been given by media experts and material experts. In this individual trial, the test subjects were 3 students who were taken based on high, medium, and low intelligence levels. It is intended to represent the whole student.

The value of the interactive learning computer media program based on individual trials is:

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

$$= \frac{21+6}{30} \text{ x } 100\% = 90\ \%$$

Based on the above-average results, namely 90%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

5.7.2. Small Group Trial

After revising the results of individual trials, the next step was to do small group trials of 6 students. The value of interactive learning computer media programs based on small group trials is:

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

$$= \frac{43+12}{60} \text{ x } 100\% = 91{,}8\ \%$$

Based on the above-average results, namely 91.8%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

5.7.3. Revised Individual and Small Group Trials

After conducting individual trials and small group trials, the results of the average analysis of each variable showed that interactive learning computer media did not need revision so that this interactive learning computer media had become the final result and was suitable for use in learning.

5.7.4. Trial Use

The next step is to conduct large group trials conducted on all students. The value of interactive learning computer media programs based on large group trials is:

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

$$= \frac{176 + 48}{240} \text{ x } 100\% = 94{,}58\ \%$$

Based on the above-average results, namely 94.58%, this percentage indicates that interactive learning computer media according to Arikunto (2010) is in the Very Good category.

5.8. Test Result Data Analysis

5.8.1. Calculation of Test Results

This study, using 2 classes, namely the experimental class using interactive learning computer media in the learning process, and the control class whose learning uses conventional methods.

Table 3 Pre-Test and Post-Test Results for the Experiment Class and Control Class

Control Class					**Experimental Class**			
Subject	Pre Test (X1)	Post Test (X2)	Differ (X)	X2	Pre Test (Y1)	Pos Test (Y2)	Differ (Y)	Y2
1	55	75	20	400	55	80	25	625
2	65	70	5	25	55	80	25	625
3	75	80	5	25	60	80	20	400
4	55	75	20	400	65	85	20	400
5	50	70	20	400	65	80	15	225
6	65	75	10	100	60	80	20	400
7	70	90	20	400	55	85	30	900
8	55	70	15	225	55	85	30	900
9	60	80	20	400	60	85	25	625
10	55	80	25	625	65	80	15	225
11	60	75	15	225	55	80	25	625
12	65	80	15	225	45	75	30	900
13	55	70	15	225	55	80	25	625
14	45	70	25	625	55	80	25	625
15	50	75	25	625	75	100	25	625
16	70	90	20	400	75	90	15	225
17	55	75	20	400	60	80	20	400
18	40	75	35	1225	50	85	35	1225
19	50	70	20	400	65	80	15	225
20	45	65	20	400	40	70	30	900
21	65	75	10	100	55	85	30	900
22	65	80	15	225	65	85	20	400
23	60	75	15	225	50	80	30	900
24	60	80	20	400	60	85	25	625
Amount	1390	1820	430	8700	1400	1975	575	14525

The results of the data in Table 3 are analyzed using the following formula:

$$M_x = \frac{\sum x}{N} = \frac{430}{24} = 17{,}91$$

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

$$= 8700 - \frac{(430)^2}{24}$$

$$= 8700 - \frac{184900}{24}$$

$$= 8700 - 7704{,}17$$

$$= 995{,}83$$

$$t = \frac{M_y - M_x}{\sqrt{\left(\frac{\sum x^2 + \sum y^2}{N_x + N_y - 2}\right)\left(\frac{1}{N_x} + \frac{1}{N_y}\right)}}$$

$$t = \frac{23{,}95 - 17{,}91}{\sqrt{\left(\frac{995{,}83 + 748{,}96}{24 + 24 - 2}\right)\left(\frac{1}{24} + \frac{1}{24}\right)}}$$

$$t = \frac{6{,}04}{\sqrt{\left(\frac{1744{,}79}{46}\right)\left(\frac{2}{24}\right)}}$$

$$t = \frac{6{,}04}{\sqrt{37{,}93 \times 0{,}08}}$$

$$t = \frac{6{,}04}{\sqrt{3{,}034}}$$

$$t = \frac{6{,}04}{1{,}74}$$

$$t = 3{,}47$$

d. b $= (N_x + N_y - 2) = 46$

$$M_y = \frac{\sum y}{N} = \frac{575}{24} = 23{,}95$$

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

$$= 14525 - \frac{(575)^2}{24}$$

$$= 14525 - \frac{330625}{24}$$

$$= 14525 - 13776{,}04$$

$$= 748{,}96$$

Based on the calculation of the results of the pre-test and post-test in the control group and the experimental group, it is obtained t count with a value of t_0 = 3.47 while db = 46 with a significance level of critical value at t_0.05 = 1.68 and the level t_0.01 = 2.42.

1.68 <2.42 <3.47

So it can be concluded based on the results of these trials it was found that the price of t_0 was greater than the price of t_0.05 and t_0.01, namely 1.68 <2.42 <3.47. This shows that the use of interactive learning computer media in the experimental group can improve student learning outcomes.

6. Conclusion

After going through the development stages using the R & D development model (Borg and Gall) in Sugiyono (2009) which has been carried out starting from the development preparation stage, development implementation, to product testing, the development of interactive learning computer media can be drawn conclusions on The data obtained are as follows:

a. Interactive Learning Computer Media has assessed the feasibility of the media including the following: the results of the assessment from a material expert I and material expert II are in the very good category. The results of the assessment by media expert I and media expert II were also in the very good category. The results of individual trials obtained a very good category value. The results of the small group trial were in the very good category. The results of the large group trial were in the very good category. 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 the test data analysis, learning using interactive learning computer media has been proven to improve student learning outcomes in the fluid mechanics' course application in students of the STTAL Mechanical Engineering D3 study program. This is evidenced by the post-test scores of the experimental group (using interactive learning computer media) are better than the post-test scores of the control group (conventional class).

7. Future work

This development research produces interactive learning computer media in the fluid mechanics' course of applications for students of the STTAL Mechanical Engineering D3 study program. Therefore, researchers provide suggestions related to the resulting interactive learning computer media.

7.1. Utilization

In the use of interactive learning computer media that has been developed, it is hoped that several important things are considered, namely:

i. The product developed can be used in learning in fluid mechanics' course application for students of the STTAL Mechanical Engineering D3 study program
ii. Students can copy interactive learning computer media of fluid mechanics courses apply to students of the STTAL Mechanical Engineering D3 study program which can later be used for independent learning.

7.2. Product Dissemination Suggestions

The development of interactive learning computer media is only for students of the D3 Mechanical Engineering STTAL study program. If it is used by other students, it must first be reviewed on the analysis of needs, environmental conditions, target characteristics, the curriculum used, facilities and infrastructure, and the funds required.

7.3. Further Development Suggestions

There are several suggestions for further development, including:

i. 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.
ii. Pay more attention to the quality of learning media that are more interactive and innovative, so that they are more attractive to students.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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