



Heavy Equipment Education 2.0 Development as an Android-Based Learning Space

Hasan Maksum¹, Hannyka Febriano²

^{1,2}Technology and Vocational Education, Padang State University, Indonesia

hasan@ft.unp.ac.id¹, hannykaf@gmail.com²

ABSTRACT

Keywords:

Heavy Equipment Education 2.0; Validity; Practicality; Effectiveness.

The pandemic period of covid-19 is a difficult time for students and teachers, especially in the vocational high school students. One of the difficulties faced by students is learning online from home while many students do not have internet access. So developed an android application that can be accessed online and offline to help students in learning from home. The purpose of this research is to create a product in the form of android-based learning media that is valid, practical, and effective, so as to help the learning process during the Covid-19 pandemic. This application was then named Heavy equipment Education 2.0. This research is a development research that uses four-D method (define, design, development, disseminate) as the development method. From the research that has been done, it can be concluded that Heavy equipment Education 2.0 application is valid as a learning medium with a validity value of 0.94. Heavy equipment Education 2.0 application. practicality with a practicality score by the teacher of 91.5% while the practicality score by the student is 90%. As for its effectiveness value, Heavy equipment Education 2.0 application. able to improve student learning outcomes 97%.

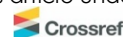


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A. INTRODUCTION

During the Covid-19 pandemic, it is a challenge for educators to not only rely on pedagogic skills in the classroom, but also creative mastery of Science and Technology (Hindun et al., 2021), this is because during the pandemic students are not encouraged to study face-to-face at school, but rather study online at home (Domenico et al., 2020). Pandemic period requires teachers to be able to utilize science and technology to teach online (Wahyono et al., 2020).

Mastery of science and technology by educators will be very helpful in creating a comfortable and conducive learning atmosphere. After initial observations were made at SMK Negeri 2 Dumai in the subjects of Heavy Equipment Undercarriage Powertrain during the covid-19 pandemic, it can be known that the learning process is done using power point media, video, fundamental books, Classroom, not yet maximized, this can be seen in the value obtained by students in odd semesters with an average of 60. The number of students who did not complete was 9 out of 20 students. Percentage of students completed and failed In odd semester 2020/2021 are as Table 1 follows.

Table 1. Percentage of students completed and failed In odd semester 2020/2021.

Student Subjects	Complete Student	Failure	Number of Students
PUAB	11	9	20
Percentage	55%	45%	100%

The Covid-19 pandemic is a difficult time for students and teachers in the Heavy Equipment Expertise Program of SMK Negeri 2 Dumai, where there are many obstacles in the online teaching and learning process at SMK Negeri 2 Dumai. During this pandemic, vocational school students, especially in Dumai, Riau Province, were not allowed to study directly at school, but rather to learn from their homes (Makarim et al., 2021)

This condition is one of the challenges for teachers especially in the field of automotive studies to master science and technology. This is because learning from home using media in the form of technology is not commonly applied in the process of face-to-face learning. Google Classroom, Zoom, WA, Quizzizz, and so on apps become alternative media for students and teachers to interact to achieve learning goals (Fitra & Maksum, 2021)

After 1 year of online learning was implemented in March 2020, there were various obstacles when online learning took place especially at the vocational level. One of the main problems is that students cannot follow the learning as they should because there are no supporting facilities such as smartphones and internet access.

Based on the situation faced by teachers and students of TAB SMK Negeri 2 Dumai, it was designed an android-based learning media named "Heavy Equipment Education 1.0". This application was first used for the 2020 Heavy Equipment Engineering Skills Competency Competition competition, but to be used as a learning medium has not been qualified because it is not yet in accordance with the revised 2013 curriculum. The specifications of Heavy Equipment Education 1.0 are as Table 2 follows.

Table 2. specifications of Heavy Equipment Education 1.0

App version	1.0
App size	54 Mb
Android version	Alpha ^s / _d Android 10
Internet data usage	Offline system operations Partial content online
Conformity with curriculum	No (no learning materials according to curriculum)

Based on the weakness of Heavy Equipment Education 1.0 which has not been in accordance with the revised 2013 curriculum, it is necessary to further develop to comply with the curriculum that is based on heavy equipment engineering SMKN 2 Dumai. Heavy Equipment Education application that will be developed hereinafter referred to as "Heavy Equipment Education 2.0". The version is a development of the first generation where menus and displays have been developed to make it more interesting and in accordance with the revised 2013 curriculum.

Heavy Equipment Education 2.0 app is built with an Android application package (apk) maker application that can be downloaded for free in playstore, the application is sketchware

version 3.10.0. sketchware was chosen to make heavy equipment education because the tools are complete, the color blend is also many, and most importantly its easy operation.

Heavy Equipment Education 2.0 aims to make it easier for heavy equipment students to obtain learning resources and can attract students in reading. The study room to be developed is an interactive media in the form of an android application that presents an understanding of the powertrain and undercariage system consisting of the identification of the complement, and how the system works, the steps to remove the install of components, disassemble assemble components, as well as the introduction of machine unit parts.

Heavy Equipment Education 2.0 is expected to improve the effectiveness of learning because before learning begins the application that has been shared will attract students in reading and learning materials and students are no longer difficult to find material about heavy equipment units. The increasing interest of students to read has become the initial foundation for receiving teaching methods such as demonstrations from teachers or demonstrating for themselves material on Powertrain Undercariage Alat Berat.

The basic concept of learning media development is the TPACK concept introduced by Misrha and Koehler. The content of the concept of TPACK there are 3 namely Tecnological knowledge, pedagogical knowledge, content knowledge (Wijaya et al., 2020). As has been said in the background that during the covid-19 pandemic, the defense process not only relies on pedagogical abilities and the mastery of learning materials, but teachers must also master technology so that the message delivered to students can be absorbed better. TPACK Concept Map are as Figure 1 follows.

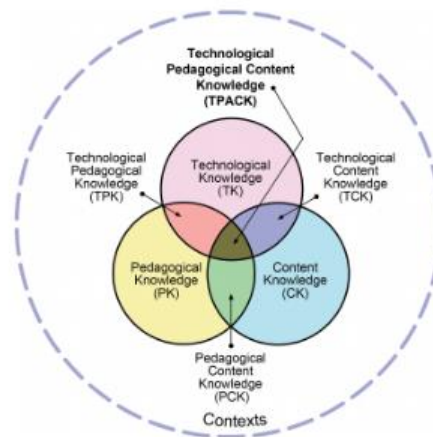


Figure 1. TPACK Concept Map

The media comes from the word Medio or intermediary. It can also be interpreted as a communication tool used to convey information (Asmariyani, 2016). While learning is a process of two-way interaction between teachers and students in a learning environment (Netriwati, 2019). Based on the opinion of learning media experts can be concluded as a tool to convey information from educators or teachers to students or students in order to attract students' attention in learning, so that learning objectives can be achieved.

Learning space is one type of learning media used by developers in the learning process that is electronic and accessed online. Examples of existing study rooms are the Teachers Room, Google Classroom, etc. All of these study rooms are accessed online. The downside is that students will have difficulty accessing if there is no internet access. Therefore, a study room is

developed that will help students learn independently both at school and outside school hours with or without internet access.

In developing a learning medium there are 8 criteria for selecting a learning medium, the eight criteria are 1) the learning objectives can be achieved as planned; 2) The selected media is effective compared to other media; 3) The media used is easy to obtain and apply; 4) Media used in accordance with the ability of learners in other words easy to use; 5) Easy to use by the layman though; 6) The media used is not harmful to its users; 7) The cost of making alternative media hendalah affordable, do not be more expensive than the media that has been circulating; 8) The media chosen must be durable and not easily damaged (Mulyono et al., 2021)

Based on 8 criteria of learning media selection that has been put forward by media experts, a media was developed in the form of a study room called "Heavy Equipment Education 2.0", which is an android application used to accompany the print module commonly used by teachers in delivering learning by putting forward 8 criteria for the selection of learning media submitted by experts above. Heavy Equipment Education 2.0 android application is planned to 2.0 specifically apply all modules in the heavy equipment engineering subjects in the automotive engineering department of SMK, but for this initial stage is only focused on one subject namely PUAB.

Machine Powertrain and Undercarriage we called PUAB is one of the subjects in the automotive engineering department in the field of Heavy Equipment Engineering. Basic competencies that must be achieved by grade XI TAB students in puab subjects are: a) Students are able to understand how Torque Converter works, b) Students are able to understand how transmission system works, c) Students are able to understand how differential system works, d) Students are able to understand how steering system works, e) Students are able to understand how the Brake System works, and f) Students are able to understand how Final Drive & Undercarriage works.

Heavy equipment education application is developed using sketchware software. Sketchware is a scratch programming block based on integrated development environment to develop mobile android applications (Mulyono et al., 2021). Sketchware specifications used are as Table 3 follows.

Software name	Sketchware
Software version	3.10.0
System OS	Android
Software size	53Mb
Internet data usage	No
In-app purchases	Yes

Heavy Equipment Education 2.0 application is designed to be accessible using two modes, online and offline in order to help students in obtaining learning resources. Students who do not get internet access can still use the Heavy Equipment Education 2.0 application with its offline mode of Library menu and subjects. Students with internet access can access even more learning resources such as Classroom, SIS, and Caterpillar University. With the dual mode system design, this application is expected to be able to attract students' learning interests and facilitate students in accessing learning resources. The specifications of Heavy Equipment Education 2.0 are as Table 4 follows.

Table 4. Heavy Equipment Education 2.0 Specifications

App version	2.0
App size	69,55 Mb
OS	Android
Internet data usage	Offline system operations Partial content online
Conformity with curriculum	yes

Figure 2 shows that there are buttons that can already be used and that there are some buttons that cannot be used yet. The unused buttons in Figure 2 are white, while those with colored backgrounds can already be used or operated. The inaccessible navigation buttons will be enabled in further development of the Heavy Equipment Education 2.0 application.

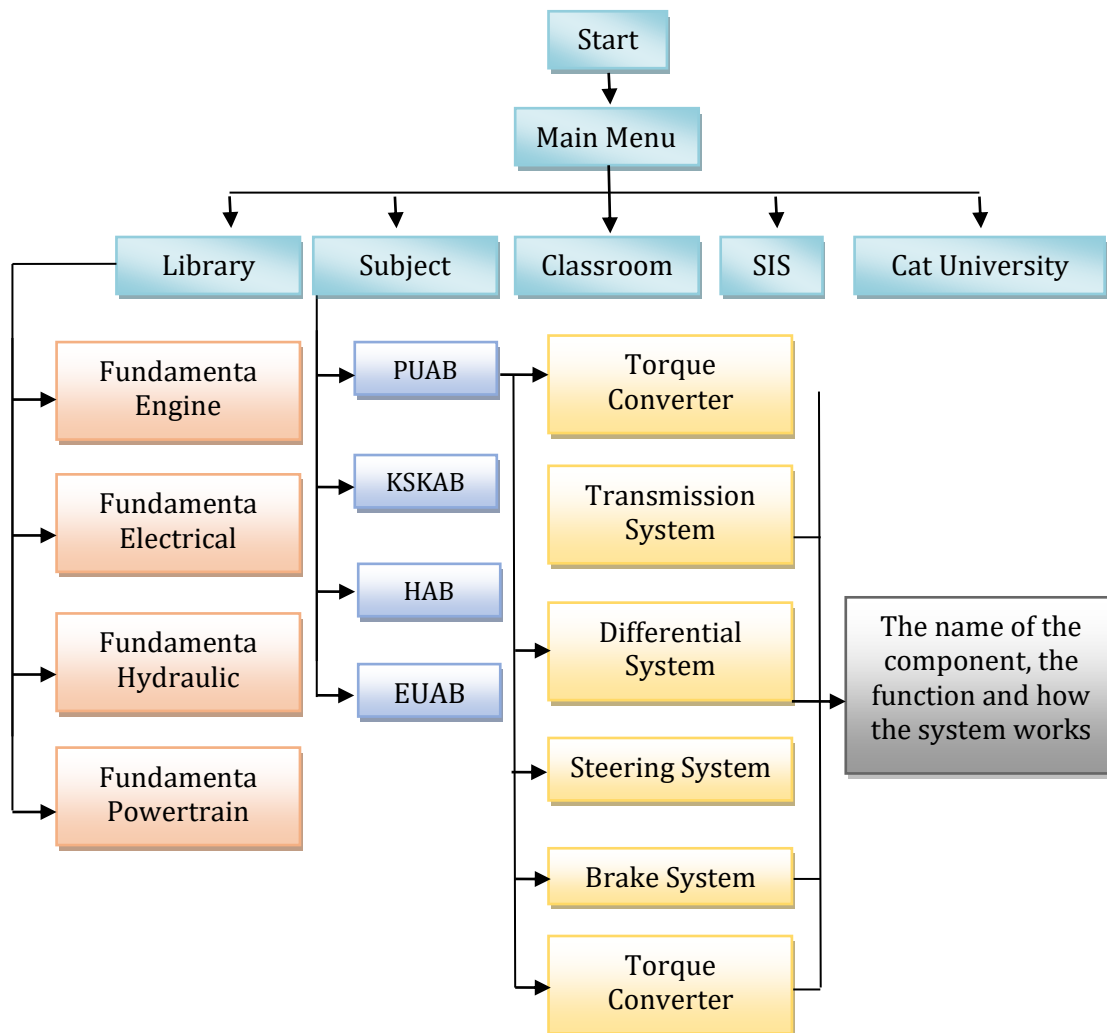


Figure 2. Heavy Equipment Education 2.0 Navigation Structure

B. METHODS

This research is research Research and Development (R&D). Research development or known as Research and Development (R&D) is a systematic research to produce a product in the form of books, modules, or other learning aids that are practical, and efficient (Ganfrie, 2019).

The development method applied to this study is the Four-D model. Four-D model development method consists of 4 main stages namely, define, design, development, Disseminate (Fitra & Maksum, 2021).

1. Define

Define stage has the goal to establish the basic problems faced in learning, so that a learning media development is needed (Rifdarmon, 2018). At this stage the researchers analyzed the obstacles faced by students and teachers related to online teaching..

2. Design

Design is the second procedure of the 4D model that aims to create a new product to solve the basic problems that have been found at the define stage (Maksum & Lapisa, 2020). At the design stage developed an application called Heavy Equipment Education 2.0. this application is expected to be able to help the teaching and learning process in vocational high schools.

3. Development

At this stage, content and design will be developed that did not exist in previous versions of the application. Not all the results of a media development that can be used to be an effective and practical medium, therefore every learning medium developed needs to pass the assessment procedure. It is at this stage of development that a development will be tested for its effectiveness, practicality, and validity.

The Validation process involves media experts and material experts. to know the media developed valid then disseminated validation sheet to media experts and material experts. after the data is obtained it will be analyzed using Aikens' V analysis technique. If the value of V or the validity value of the product is obtained 0.61-1 then the media is declared Valid and eligible for use (Adawiyah et al., 2019).

To find out if the media developed practically then disseminated practicality questionnaires to students and teachers of vocational high schools. Once the data is obtained it is analyzed with practicality formulas. If the practical value is between 81-100 then the media can be said to be very practical (Denia et al., 2018). In order to understand the category of practicality can be seen in Table 6.

Table 6. Media Practicality Category

No	Value	Category
1	81 – 100	Very Practical
2	61-80	Practical
3	41-60	Quite Practical
4	21-40	Less Practical
5	0-20	Impractical

4. Disseminate

Disseminate is done to students, teachers, and the school so that it can be utilized as widely as possible (Amir et al., 2020). At the disseminate stage of the application that has been declared valid based on Aiken's V and practically based on table 6, it will be disseminated to teachers who teach in vocational high schools.

The test subject of Heavy Equipment Education 2.0 application as an android-based learning medium in The Heavy Equipment Undercariage and Machine Tools (PUAB) subjects is a grade XI student of the Heavy Equipment Engineering Skills Program (TAB). TAB SMKN 2 Dumai has cooperation with P.T. Trakindo Utama which in the agreement tab students should not be more

than 20 people per generation. So in this study taken entirely from tab grade XI students became the subject of research, which amounted to 20 students.

C. RESULT AND DISCUSSION

Heavy Equipment Education application development using 4D method that must go through certain stages before disseminating. The stages are:

1. Define

In this study has been analyzed the condition of students who have difficulty in carrying out online learning due to several factors such as, internet access is not adequate, difficult to measure their own abilities when self-learning at home, and so on.

2. Design

Based on the problems faced, an android application called heavy equipment education 2.0 was developed. following design of heavy equipment education 2.0. following design of heavy equipment education 2.0

a. Opening Page

On the opening page the user will be faced with a password. Users must enter a password because this application is only allowed for students and Heavy Equipment Engineering Teachers who work with P.T. Trakindo Utama. This is because in the application contains books and service manuals issued by trakindo. Heavy Equipment Education 2.0 Opening Page as Figure 3 follows.



Figure 3. Heavy Equipment Education 2.0 Opening Page

b. Main Menu Page

On this page comes with menus that can be accessed online and offline. Among the menus accessible online are Classroom, SIS, and caterpillar University. For students who do not

have internet access, they can access offline menus such as Library and Mata Pelajaran. Main Menu Page as Figure 4 follows.



Figure 4. Main Menu Page Before Screen Scroll and Main Menu Page After Screen Scroll

c. Subject Page

In this study is still focused on one subject namely powertrain undercarriage heavy equipment. Subject Menu Page as Figure 5 follows.



Figure 5. Subject Menu Page

d. SIS Page

On the SIS menu students and teachers can practically open the service manual of all caterpillar units. SIS Page as Figure 6 follows.

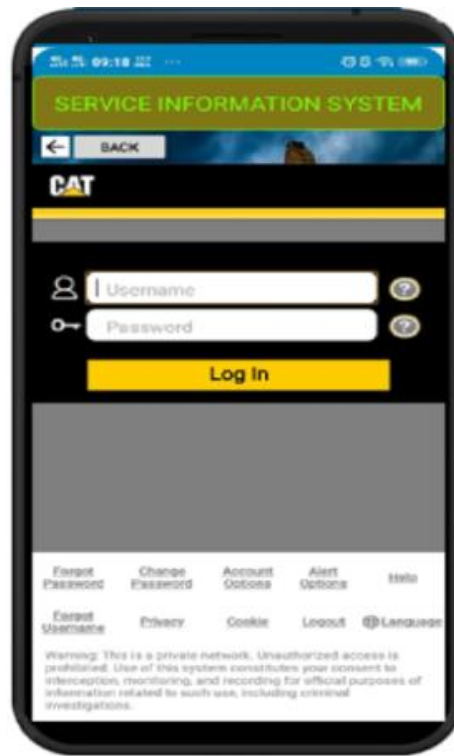


Figure 6. SIS Page

e. Information Page

The information page includes instructions for using the application, contact details, and the profile of the application builder. Information Page as Figure 7 follows.

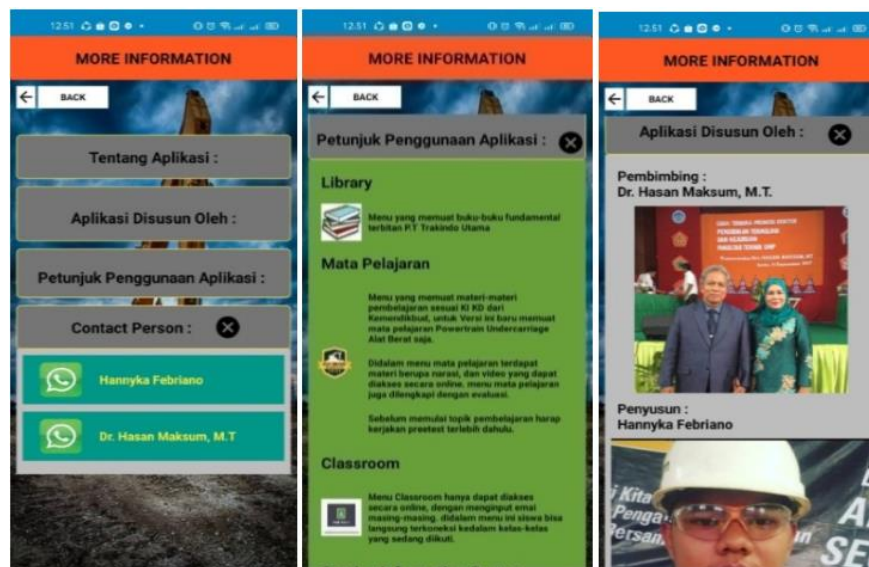


Figure 7. Information Page

3. Development

At this stage will be developed content and design that does not exist in previous versions of the application. Not all the results of a media development that can be used to be an effective and practical medium, therefore every learning medium developed needs to pass the assessment

procedure. It is at this stage of development that a development will be tested for its effectiveness, practicality, and validity.

a. Validity Test

The purpose of media validation is to find out if the developed media qualifies as a learning medium. The data obtained from the collection of validation sheets from media experts will then be entered into aiken' V statistics formula as in Table 7.

Table 7. Media Validity

MEDIA VALIDITY						
Assessment Aspects	Item Questions	R		Σs	Aikens V	Description
		Validator 1	Validator 2			
Didactic	Item 1	5	5	8	1,00	Valid
	Item 2	5	4	7	0,88	Valid
	Item 3	5	5	8	1,00	Valid
	Item 4	5	5	8	1,00	Valid
	Item 5	5	4	7	0,88	Valid
	Item 6	4	5	7	0,88	Valid
Average					0,95	V
Construction	Item 1	4	5	7	0,88	Valid
	Item 2	5	5	8	1,00	Valid
	Item 3	5	5	8	1,00	Valid
	Item 4	5	5	8	1,00	Valid
	Item 5	5	4	7	0,88	Valid
	Item 6	5	5	8	1,00	Valid
	Item 7	4	5	7	0,88	Valid
Average					0,96	V
Technical	Item 1	4	5	7	0,88	Valid
	Item 2	5	4	7	0,88	Valid
	Item 3	5	4	7	0,88	Valid
	Item 4	5	5	8	1,00	Valid
Average					0,91	V
Overall Average					0,94	Valid

b. Practicality Test

Practicality data obtained from the response of PUAB subject teachers and grade XI TAB students. The data will then be calculated to see the category of media practicality. From the calculation results can be concluded that the media developed is very practical. This can be seen in Table 8.

Table 8. The Value of Teacher Practicality
Practicality Sheet Filled By The Teacher

Assessment Aspects	Rating Items	Score max	P 1	P 2	P1 %	P2%	Describe
Learning	Item 1	5	5	4	94	89	Very Practical
	Item 2	5	4	4			

Item 3	5	5	5
Item 4	5	5	5
Item 5	5	5	4
Item 6	5	5	5
Item 7	5	4	4
Item 8	5	5	5
Item 9	5	4	5
Item 10	5	5	4
Item 11	5	5	4
Item 12	5	5	5
Item 13	5	4	4
Total Value	65	61	58
Overall Average			91,5 %

While the practicality value of the student's practicality sheet is also in the very practical category with an average of 90%, can be seen in Figure 8.

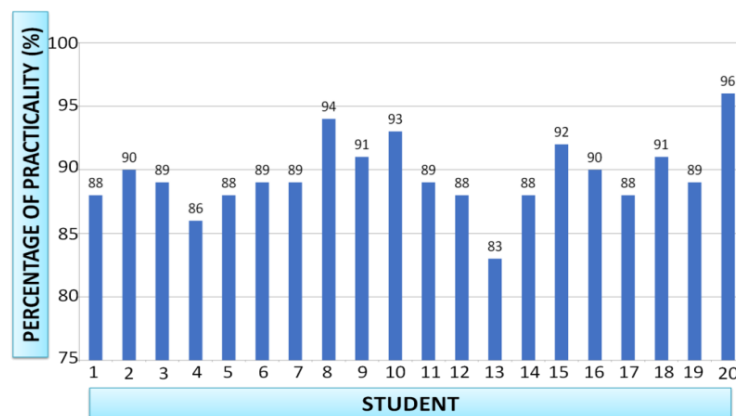


Figure 8. Student practicality value

c. Effectiveness Test

Effectiveness test is obtained from student learning outcomes, where the learning outcomes are an effective aspect to be observed in the learning process. Effectiveness test conducted after heavy equipment education 2.0. as a learning medium. The learning results were measured using multiple choice questions as pretest and posttest which each amounted to 10 questions per basic competency tested. The questions used have been validated, the results of this evaluation are then used to measure the effectiveness of Heavy Equipment Education 2.0. as a learning medium.

The average pretest XI TAB result is 41, while the post test average is 80. Based on table 9, it can be known that there is an increase in students' grades before studying using Heavy Equipment Education 2.0. and after using Heavy Equipment Education 2.0 judging by its pretest and posttest values. It can be concluded that Heavy Equipment Education 2.0 is effective as a learning medium in the pandemic because it is able to increase students' grades by 97%. Comparison of Pretest And Post Test Student Scores as Figure 9 follows.

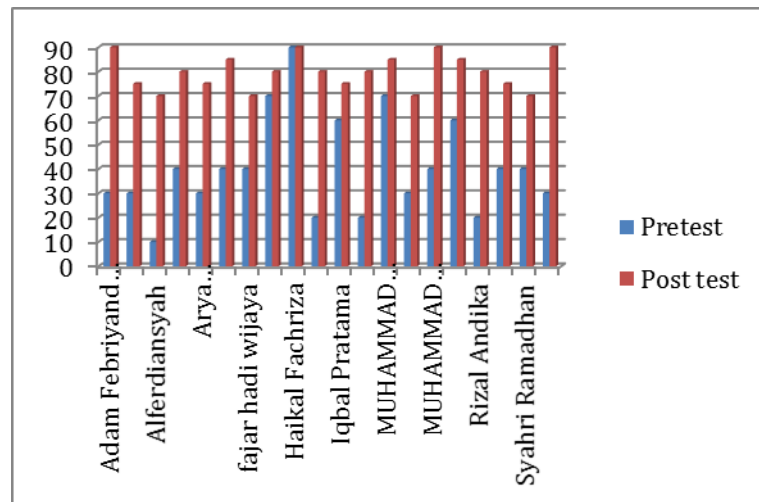


Figure 9. Comparison of Pretest And Post Test Student Scores

4. Disseminate

Dessiminate is done to students XI TAB SMKN 2 Dumai, teachers TAB SMKN 2 Dumai, and SMKN 2 Dumai in order to be utilized as widely as possible.

D. CONCLUSION AND SUGGESTIONS

Based on the research of Heavy Equipment Education Development 2.0 as a learning medium, it can be concluded that Heavy Equipment Education 2.0 development research has successfully created an android-based application that can be used for self-learning and able to measure students' abilities independently.

The results of data analysis of Heavy Equipment Education 2.0 as a learning medium from product validity test based on material validation were declared "Valid" with an average score of 0.88 and media validation obtained an average score of 0.94 declared "Valid". As for practicality tests for teachers obtained a score of 91.5% declared "Very Practical" and for students obtained a score of 90.% stated "Very Practical". Then for the effectiveness test obtained from analyzing the percentage increase in student learning outcomes using heavy equipment education 2.0 application with a percentage of 97%. To the next researchers, it is expected that all menus that have not been active will be completed and used as further research.

As for the advice to students, should make the most of the facilities provided by teachers and schools, then to teachers should continue to create innovations that can improve student learning outcomes, both in terms of learning media and others, for further researchers are expected all menus that are not yet active and e-books that are still not to be completed and used as further research , then to the principal should provide facilities and reword to teachers who creatively create the latest innovations, lastly to the head of the heavy equipment engineering expertise program is expected to facilitate the next researcher in disseminating the application heavy equipment education 3.0 which is a follow-up of Heavy Equipment Education 2.0.

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