Development of android-based mobile learning media to increase learning results in vocational high schools

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Abstract: The purpose of this research is to produce android-based mobile learning media and to determine its effectiveness on student learning outcomes. This research is a type of research and development method conducted through the ADDIE model, so this research is a type of research and development. The media was validated by experts in three fields, namely material, media, and language. The test subjects were 32 vocational students majoring in Automotive Engineering. Data analysis conducted to evaluate the effectiveness of the media involves the use of n-gain score and paired sample test statistics. The results of the study prove that, (1) the mobile learning media developed is very feasible to be used in learning activities for equipment and supplies in the workplace based on the results of validation by material experts of 87.8%, language experts of 95%, media experts of 90.5%, and student responses of 93.3%. (2) mobile learning media is very effective to use and has a significant effect on improving student learning outcomes, based on the results of the average score of the field trial after using mobile learning of 86.94 with a gain value of 0.72 with high criteria and t-test results of 0.00 <0.05. (3) the application of mobile learning as learning media makes it possible for students to learn independently.

Keywords: Development, effectiveness, learning outcomes, mobile learning, workplace

Abstrak: Tujuan dari penelitian ini adalah untuk menghasilkan media mobile learning berbasis android dan untuk mengetahui keefektifannya terhadap hasil belajar siswa. Penelitian ini adalah jenis penelitan bermetode pegenmbangan yang dilakukan melalui model ADDIE, sehingga penelitian ini adalah jenis penelitan dan pengembangan. Media divalidasi oleh para ahli dalam tiga bidang, yakni materi, media, dan bahasa. Subyek uji coba yaitu siswa SMK jurusan Teknik Otomotif berjumlah 32 orang. Analisis data yang dilakukan untuk mengevaluasi efektivitas media melibatkan penggunaan n-gain score dan uji statistik paired sample test. Hasil penelitian membuktikan bahwa, (1) media mobile learning yang dikembangkan sangat layak untuk digunakan pada kegiatan pembelajaran peralatan dan perlengkapan di tempat kerja berdasarkan hasil validasi oleh ahli materi sebesar 87,8%, ahli bahasa sebesar 95%, ahli media sebesar 90,5%, dan tanggapan siswa sebesar 93,3%. (2) media mobile learning sangat efektif untuk digunakan dan memiliki pengaruh yang signifikan terhadap peningkatan hasi belajar siswa, berdasarkan dari hasil skor rata-rata uji coba lapangan setelah menggunakan mobile learning sebesar 86,94 dengan nilai gain 0,72 dengan kriteria tinggi dan hasil uji-t 0,00<0,05. (3) penerapan mobile learning sebagai media pembelajaran sangat memungkinkan untuk siswa dapat belajar secara mandiri.

Kata kunci: Pengembangan, efektivitas, hasil pembelajaran, mobile learning, tempat kerja

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INTRODUCTION

Vocational School is a formal education institute that provides a vocational education program at itermediate level as continuation from High School Level Education or equivalent (Wijaya et al., 2021). Vocational School prepares its students to have knowledge and skills that will later become provisions for going directly into the industry world. (Adkha et al., 2021). Additionally, Vocational School charges students to possess a great productivity attitude so that it will create a standard of graduation that have competence

and skills (Oksa & Soenarto, 2020). Most of the students currently attending vocational schools are Generation Z, who have been introduced to various digital technologies since they were born (Iskandar, 2024). Various technologies connected to the internet have familiarized young generation Z children even before they enter formal education. This has resulted in today's students tending to be more interested in playing social media than reading books.

Along with the development of increasingly advanced technology, a teacher is required to come up with creative ideas in using learning media (Mislan & Santoso, 2019). It would be better if teachers could master computer programming knowledge so that they can utilize available technology and facilitate the learning process (Ceha et al., 2016). However, the reality that happens in the field is still not as expected. One of the reasons is that teachers are still not familiar with the developing technology (Nahdi et al., 2020). This is also a problem that occurs in one of the private vocational schools located in Pedurungan District, Semarang City, Central Java Province. This school focuses on the field of expertise in Manufacturing Technology and Engineering which is divided into two expertise programs, namely Electronics Engineering and Automotive Engineering with a 3-year education program period. In Electronics Engineering expertise program there is a concentration of expertise in Audio Video Engineering. For Automotive Engineering expertise program, there is a concentration of Light Vehicle Engineering expertise which will be the object of research by researcher.

Based on the learning outcomes of the "Merdeka" curriculum, especially in the automotive expertise program, students must be able to master the elements of equipment and equipment in the workplace. Elements of tools and equipment in the workplace will be encountered by learners when they are in first grade of Light Vehicle Engineering (phase E). The general achievement of phase E is that learners will get an overall picture of the automotive expertise program, with the aim of fostering passion, vision, imagination, and creativity as a process of planning and implementing learning activities. The outcome of phase E, students are capable in properly using the tools and equipment available in the automotive workshop which includes preparation, calibration, and use of appropriate tools and equipment based on function, type, and repair manual (Kemendikbud, 2024).

Based on the observation, students were found less able to operate various kinds of automotive equipment and measuring tools. Students often forget about how to use the equipment and tools in the workshop when practicing from what the teacher has taught during class. Teachers also have to practice how to use the equipment in the workshop. So there needs to be interactive media that can represent this (Maulidi et al., 2022). The learning results of first grade Light Vehicle Engineering students during the 2022/2023 even semester learning year, totaling 93 students, show that there are still many students who get scores below the average. For the average value of the elements of equipment and equipment in the workplace is 79. From this value there are still 41 students scoring below the average.

On the learning activity in class, students are still less active in expressing opinions or asking questions during learning activities, while the concept of the "Merdeka" curriculum itself is that students act as the center of learning or known as student-centered learning. The teacher only serves as a companion and facilitator. By making students the center of learning, students will have the opportunity as well as facilities to create their own

knowledge so the students will understand more in acquiring knowledge and can improve the quality of themselves. (Muliarta, 2018). Another problem is the lack of complete learning media that can assist teachers in teaching material. The media of learning used are still limited to whiteboards, power points, and practical tools. Learning media has a vital role in achieving learning goals. The usage of media in the learning activity will provide effectiveness in conveying the content and messages contained in the learning (Mukarromah & Andriana, 2022).

To address this, a transition is necessary to make from conventional learning media to digital-based learning media. The learning media needed is interactive and easily accessible anywhere and anytime, so that it can raise the interests and motivation of students in learning (Dita et al., 2024). One of which is by utilizing android as a mobile learning media. Almost all students have an android that is suitable for use and the school also provides a wi-fi network that can be used to access the internet. The use of android has the potential to help improve motivation and learning outcomes (Yunus & Fransisca, 2020). Students become more active and enthusiastic in involving in learning activities (Hasbiyati, 2020).

The learning process is the activity of conveying certain messages and ideas from learning sources to recipients with the aim that the messages contained in the learning material can be received by students (Masdul, 2018). The learning and teaching activity can also be interpreted as an interaction process that has normative values with objectives according to the provisions applicable in schools in the learning process (Zagoto et al., 2019). The achievement of a learning process can be seen from the learning outcomes of students. Learning results are achievements achieved by students academically by actively asking and answering questions, as well as carrying out exams and giving assignments to determine students' abilities. (Dakhi, 2020; Iskandar, 2019).

Starting in 2021, vocation schools have gradually begun to implement the 'Merdeka' curriculum in the process of learning. The concentration of Light Vehicle Engineering (LVE) expertise at SMK Tlogosari Semarang has learning outcomes about tools and equipment in the workplace in the first grade Automotive Engineering Basics subject. This element consists of Common Tools/General Tools, Workshop Equipments, Special Service Tools, Measuring Tools, and Diagnostic Tools (Setiawan, 2022). Common Tools/General Tools are tools that are often used in dismantling, repairing, and installing automotive components. This equipment is classified into two, namely hand tools and power tools. Hand tools are automotive tools whose power comes only from human power, while power tools are work equipment used to speed up and facilitate automotive work that uses additional power apart from human power.

Workshop Equipment is additional equipment/tools used in automotive workshops to help and make work faster and easier. Special Service Tools (SST) are tools used during service work that has a certain level of difficulty, so it cannot be done using hand tools or power tools. Using SST will help the work to be completed more easily, quickly, and efficiently without damaging the parts being worked on. Measuring tools are tools used to measure a quantity on an object, especially in the automotive field. Diagnostic tools are tools that have the ability to detect damage to vehicles. This tool is commonly referred to as scan tools, intelligence tester, diagnostic scan tool, and vehicle scanner.

Messages in learning to be effective must be conveyed well from teachers to students either directly or using intermediaries (Maulani et al., 2024). Learning media is anything both physical and technical in learning activities that can make it clear for teachers to deliver lesson material to students, making it easier to achieve the learning objectives that have been formulated (Adam & Syastra, 2015; Marsyaelina et al., 2022). Learning media used within a classroom plays a role in attracting and maintaining attention, increasing interest in learning, managing the classroom atmosphere, and increasing absorption so that it is very important to acquire learning objectives (Iskandar et al., 2023; Widjanarko et al., 2014). Every learning media applied has unique characteristics, so it requires careful planning in using media in learning (Widodo, 2018).

Learning media develops over time. At this time, innovation in the development of learning media is very necessary so that learning can continue effectively and students do not feel bored and fed up in following the learning process (Khumaidah & Nu'man, 2021). In developing learning media, there are aspects that need to be assessed by expert judgments so that the quality of learning media becomes perfect (Yomaki et al., 2023). The material aspects assessed, namely: material suitability, material presentation, and evaluation. The language aspects assessed are: language rules, and communicative. The media aspects assessed are: display quality, usability, and applicability.

One of the recent learning media is m-learning, or mobile learning. M-learning media development can be an alternative in utilizing refined technology. It is a learning media that uses information and communication technology operated through mobile devices such as smartphones, android, PC/laptop, and tablets (Hanafi, 2012). Android is an operating system for Linux-based mobile devices that includes operating system, middleware, and applications. This Android system is an open operating system so that developers can create various application platforms as they wish (Putra et al., 2016).

In preceding researches, the use of mobile-learning media has proven to be effective in improving student learning results. M-learning has been applied to ignition system material. It was proven that after using m-learning, the average value which was initially 67.88 increased to 88.88 (Wijaya et al., 2021). The usage of Android-based m-learning is also proved to be effective when applied in arithmetic sequence and series material at SMP Negeri 07 PutuSibau (Sapitri et al., 2024). In addition, android-based pocket mobile learning media is very successful as an alternative use of learning media and has excellent effect on improving student learning outcomes (Ihsan & Akhmad, 2022).

There are also suggestions from previous research that will be applied in this study which is development conducted on different subjects. In this case, it will be applied to the subject of tools and equipment at work. Then the content material will also add video so that students take further interest when learning (Wijaya et al., 2021). Therefore, the intention of this research is to build android-based mobile learning media and to determine the improvement of student learning outcomes on the elements of equipment and supplies in the workplace.

METHOD

The kind of research conducted is development research or commonly termed Research and Development. The orientation of this research and development is to make a product in the shape of a mobile learning application. The research procedure refers to the

ADDIE development model developed because it is considered more rational and more complete (Mulyatiningsih, 2011). In its implementation strategy, the ADDIE development model has five stages: Analysis, Design, Development, Implementation, and Evaluation. However, this research was only conducted up to the development stage without reaching the implementation stage.

Analysis, which is the stage of determining the problems and needs that exist in the field, in this context, it is in a school environment. Design, which is the stage of planning the product to be developed in accordance with the problems that exist in the analysis stage and making all non-test and test instruments that will be used during the research process. Development, namely product development activities, expert validation, making revisions to the product based on the assessment of the validator, conducting a field trial after being declared valid by the validator and seeing the achievement of the development objectives. In this research, the mplementation stage was not carried out. The evaluation stage was carried out at each stage.

The subjects of this research are divided into two, namely the test subjects of the assessment conducted by experts/validators and students. Expert validators consist of material experts, linguists, and media experts who have expertise in the field of automotive equipment and equipment material and the field of learning media. For student subjects are first grade Light Vehicle Engineering class students of SMK, totaling 32 students. This research uses non-test and test instruments as data collection tools. Non-test instruments consist of validation sheets each for material expert, language expert, learning media expert, and student response questionnaires regarding the quality of learning media. The test instrument is a cognitive learning outcome test instrument (Iskandar, Rusiyanto, et al., 2023).

According to Abidin and Purbawanto (2015), answers from validators can be analyzed using descriptive statistics with the following score range.

Table 1. Response validator scale

Interpretation	Score Percentage
Very Valid	84% - 100%
Valid	68% - 83%
Quite Valid	52% - 67%
Less Valid	36% - 51%
Not Valid	20% - 35%

The percentage of validator assessment (PPV) is measured in the following formula:

$$\text{PPV} = \frac{\sum Jawaban\ validator}{\sum nilai\ tertinggi} \times 100 \qquad (1)$$

Data on student learning **results** are obtained from the learning outcomes' test scores in the form of 30 questions about tools and equipment in the workplace with test scores in the range 0-100. The questions' arragement includes 5 questions from each learning objective related to Workshop Equipment, Special Service Tools, Measuring Tools, and Diagnostic Tools. The difficulty level of the questions is at the C2 (understanding), C3

(applying), and C3 (analyzing), and C4 (analyzing) levels. multiple choice question tests use 5 answer options.

The increase (gain) in student learning outcomes was calculated using the following formula (Wahab et al., 2021):

$$g = \frac{Posttest\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score} \tag{2}$$

Table 2. Improvement criteria (gain)

N-Gain Score	Interpretation
g > 0.7	High
0.3 ≤ g ≤ 0.7	Medium
g < 0.3	Low

Media effectiveness test on student learning improvement was conducted with test t (paired-sample test) using Minitab. Media effectivenees measurement on student learning improvement outcome is based on a significant level of alpha 5%.

RESULTS AND DISCUSSION

Analysis stage

It is known that so far, teaching materials at SMK still use references in the form of printed books that seem rigid and use power point learning media with a monotonous display. This results in students tending to get bored (Astuti et al., 2017). The use of printed media as learning media tend to cause boredom for the student. So that the material is not conveyed properly and has implications for learning outcomes that are less than optimal. One of them is the learning element of tools and equipment in the world of work where this material contains basic knowledge that will continue to be used during practical activities in the automotive workshops. This opinion is supported by the statements of students who complain that often the material notes are lost when this knowledge is needed in a different semester.

This problem must be solved immediately, one of which is by developing creative, innovative and flexible learning media. After analysis is conducted, the next step is to look for various references in the form of e-books and journals related to the development of android-based mobile learning media.

Design stage

The learning media required in this study uses digital media that is practical and can be accessed anytime and anywhere in the shape of android-based mobile learning. This is because it can be installed on each student's smartphone. The media is also equipped with images and videos that are attractively packaged so that it will be easier and more enjoyable to read.
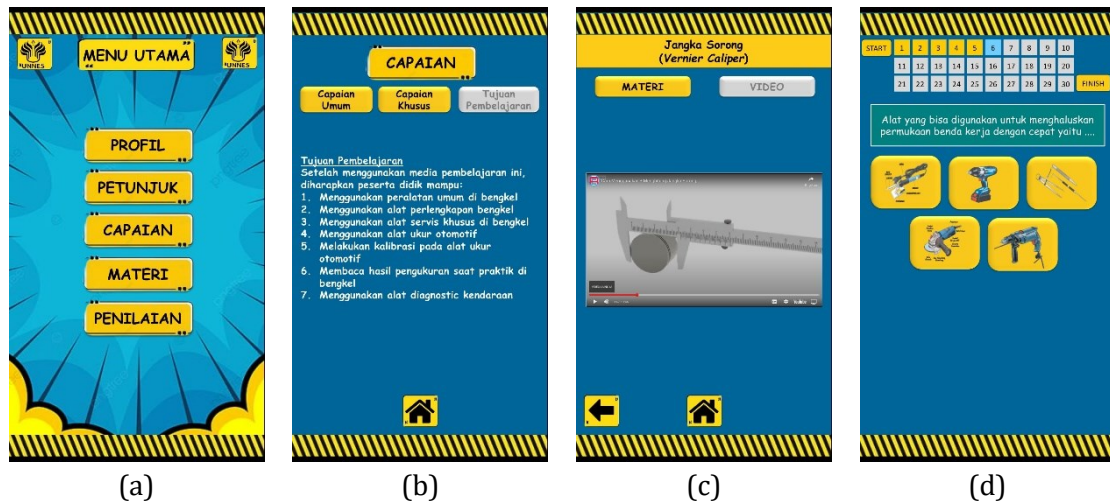
Fig. 1. Mobile learning application page on the main menu (a), learning objective (b), video (c), dan assessment (d)

The colors used in making the media are cold colors for the background and warm colors for the text and images. The reason for choosing these colors is so that the user's attention is not attracted to the background of the media, but focuses on seeing the text and images. If using blue as the media background, the recommended colors for text and images are yellow, orange, white, and light blue (Purnama, 2010).

At this stage, assessment instruments were also made in the form of tests and non-tests that would be used to calculate the suitability and effectiveness of the developed media. Non-test instruments take the form of expert validation sheets in three fields: language, material, and media, as well as questionnaires of student response regarding the quality of learning media have been validated for content and proven valid, while test instruments are in the form of items to measure student learning results.

Development Stage

After the mobile learning application is designed, the next step is product manufacturing and assessment from experts to decide the feasibility of the product. 3 validators conduct the Product Validation and these validators are media experts, language experts, and material experts.

Material expert validation was done based on the prepared rubric, in terms of the suitability of the material, material presentation, and evaluation with the following results.

Table 3. Material expert validation result

Aspect	Percentage	Interpretation
Material Suitability	87.5%	Very Valid
Material Presentation	86.9%	Very Valid
Evaluation	100%	Very Valid
Overall	87.8%	Very Valid

Based on the assessment outcomes from the material aspect (Table 3), the mobile learning media is said to be "very valid" based on the percentage results of the material

suitability aspect of 87.5%, the material presentation aspect of 86.9%, and the evaluation aspect of 100. The overall percentage value in terms of material is 87.8%. In the aspect of the suitability of the material, it received input so that the material is presented more fully and in detail on some automotive equipment. In the aspect of material presentation, it is assessed that there are several images that are still not relevant to the material. So that improvements need to be made to the learning media. In the evaluation aspect, the validator assessed that the questions prepared were in accordance with the learning goals and the presented material. The intent of the evaluation is to decide the success of learning activities and get feedback from students regarding the material taught (Adi, 2010). So that the evaluation that has been prepared is considered to be in accordance with its function.

The next validation is an assessment from media experts in terms of language. Language validation consists of aspects of language and communicative rules with the following results.

Table 4. Language expert validation result

Aspect	Percentage	Interpretation
Language Rule	90%	Very Valid
Communicative	100%	Very Valid
Overall	95%	Very Valid

Based on the outcomes of the linguist assessment (Table 4), it is known that the language rules aspect is at a percentage of 90% and the communicative aspect is 100%. The overall result of aspects in terms of language obtained a percentage of 95%. On the aspect of language rule, there were words still found to be nonstandard. On the aspect of communicative, the validator assessed that the usage of language in the learning media is clear and is in accordance with students' language skills. One factor that can affect learning to run well is when using language as a means of communication in learning (Wicaksono, 2016). According to the results of the percentages in table 3, the mobile learning application developed can be said to be "very valid" for use as learning media.

Next is the media expert validation which is reviewed from the aspects of implementation, display quality, and usability with the following outcomes.

Table 5. Media expert validation result

Aspect	Percentage	Interpretation
Quality View	89%	Very Valid
Usability	90%	Very Valid
Applicability	86.6%	Very Valid
Overall	90.5%	Very Valid

According to the results of the media expert assessment (Table 5), the percentage value in the display quality aspect was 89%, the usability aspect was 90%, and the implementation was 86.6%. On the aspect of quality view, navigation on media learning was less consistent and the text need be aligned on boths sides. On the aspect of usability, there are some buttons that need to be simplified for easier operation. The use of simple buttons

can make it easier for students to find the desired material and is responsive to student commands (Adiwisastra, 2015). On the aspect of applicability, mobile learning media must be connected to the internet if the material video is played. The overall result of the aspects in terms of media received a percentage of 90.5%. So in terms of media, mobile learning is in the "very valid" criteria. So, the three validators have agreed that the mobile learning application based on android is very effective to be used on the material of equipment and supplies in the workplace.

The next step is an effectiveness test to decide the effectiveness of the mobile learning application on improving student learning results and student responses to the application. Effectiveness is obtained only based on field tests conducted at the development stage, not at the stage of implementation. The field test was conducted on 32 students of first grade of Light Vehicle Engineering of vocational high school. Table 6 is a recapitulation of student reactions to the mobile learning application.

Table 6. Student reactions on mobile learning application

Aspect	Score Percentage	Interpretation
Material Mastery	95%	Very Valid
Usability	93%	Very Valid
Media Display	92.2%	Very Valid
Overall	93.3%	Very Valid

Based on students' responses (Table 6), mobile learning media receives a percentage value of 93,3%. In the aspect of the material mastery gets the highest percentage value, because the media is equipped with text, images, and videos. so that students can learn according to their wishes. One thing that must be considered in the media is that it must integrate several aspects, such as reading, seeing, and listening (Adiwisastra, 2015). So it is concluded that the mobile learning media is "very effective" in usage.

The test of media effectiveness was carried out using n-gain score analysis and paired sample t-test statistical tests that determines the effectiveness of mobile learning media in increasing student learning outcomes (Hidayat et al., 2024). Effectiveness testing is carried out according to the results of field trials conducted at the development stage. The results of the n-gain score analysis and paired sample t-test statistical test is seen in Table 7 and 8.

Table 7. N-Gain Score Analysis

Pretest Score	Posttest Score	N-Gain
51.84	86.94	0.72

Table 8. Paired Sample Test

Pair	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Pretest-Posttest	-35.09	9.02	-22.00	31	0.00

According to Table 7, it is shown that before using mobile learning media, the average student learning outcomes were 51.84, while after being given treatment in the shape of applying mobile-based learning as a learning media, the average learning outcomes rose to

86.94 with a value of gain of 0.72 with a high category. Also supported by the outcomes of hypothesis testing in table 8, it is known that the P-Value is 0.00 <0.05, which means that Ho is refused by accepting Ha stating that the android-based mobile learning application media is effectual and has excellent effect on student learning results on the elements of equipment and equipment in the workplace.

In previous research, it was stated that Android-based mobile learning is effective and very feasible to be developed as an innovative learning media to attract students' attention in learning activities so that it can improve student learning outcomes. In line with the opinion expressed by Putri (2019) that android-based learning media is more effective in increasing learning outcomes than traditional learning media. Septiyanto et al. (2024) also mentioned that android-based learning media is very effective in automotive learning. So Android-based mobile learning media can have a significant influence on improving student learning outcomes (Tasrif et al., 2023).

Based on the description above, Android-based mobile learning can be used as an option in developing learning media. Mobile learning is considered to be a very relevant learning medium for use in the modern era and is expected to be an alternative in solving problems in the learning process (Putra, 2019). In developing Android-based m learning media, it is very possible to be equipped with animations that are interesting and appropriate to the learning objectives, so that they can motivate students in the teaching and learning process. Apart from that, Android-based m learning media can also be equipped with evaluations in the form of tests to measure students' learning mastery which is adjusted to the learning curriculum (Juwita, 2019).

CONCLUSION

This research has successfully created an outcome in the form of android-based mobile learning media that is very suitable to be used as a learning media for equipment and tools in the workplace. This is proven by the outcomes of material expert validation with a percentage of 87.8%, language experts at 95%, media experts at 90.5%, and student responses at 93.3%. Mobile learning media has also proven effective to be applied in improving student learning outcomes. The effective indicator based itself on the n-gain test result of 0.72 and the statistical significance test is fulfilled, namely sig. 0,00 < 0,05. It is recommended that teachers can apply more creative, innovative, and effective learning media in the shape of mobile learning media. Further mobile learning development can be equipped with a simulator so that students can be more interactive when learning. It is recommended that further research be carried out up to the implementation stage.

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