JOVES (Journal of Vocational Education Studies)
VOL 8, No. 1, 2025, pp. 193-208
pISSN: 2614-7483 pISSN: 2614-7475 https://doi.org/10.12928/joves.v8i1.11897

Development of Android Application-Based Interactive Learning Media on Vehicle Instrument Panel Competence

[1] Ferizal Nurdiansyah *, [2] Putu Sudira

Universitas Negeri Yogyakarta, Indonesia

Email : [1] ferizalnurdiansyah.2023@student.uny.ac.id*, [2] putupanji6402@gmail.com

* Correspondence author

ARTICLE INFO

Article history
Received Oct 26, 2024
Revised Mar 19, 2025
Accepted Apr 11, 2025

Keywords
Learning Media
Android
Vehicle Instrument Panel

ABSTRACT

This study aims to: (1) create an interactive learning media product based on Android applications on automotive motor vehicle instrument panel competency; (2) determine the feasibility of learning media based on Android applications on vehicle instrument panel competency. This study is a type of research and development (RnD). The development of this learning media is adapted from the ADDIE (Analysis, Design, Development, Implementation and Evaluation) development model. ADDIE is used to direct the design process as determined. This study was conducted at SMK PIRI 1 Yogyakarta with the research subjects being class XI students of the Automotive Engineering Skills Program. The feasibility test stage for the results of the interactive learning media product was carried out by two material experts and two media experts, as well as trials on end users, namely students. The results of this study are: (1) the creation of an Android application-based learning media product on motor vehicle instrument panel competency; (2) The product feasibility results obtained the category "very feasible" according to material experts because they obtained an assessment score of 66 with a maximum score of 76, the category "very feasible" according to media experts because they obtained an assessment score of 53 with a maximum score of 64, and the category "feasible" according to students because they obtained an assessment score of 47.25 with a maximum score of 64. The resulting product can increase the effectiveness of learning about vehicle instrument panels in vocational high schools with automotive engineering skills program.

Introduction

Indonesia is one of the countries affected by the Covid-19 pandemic in 2020. This affects and hinders the learning process at school due to overcoming the spread of the virus in schools (Wiryanto et al., 2024). During the Covid-19 pandemic the learning process must be carried out from home via distance learning. Distance learning means that teachers cannot play their role as a source of information for students directly, but teachers need the help of information distribution media as a source of independent learning for students (Sari & Wiyasa, 2021). Through distance learning, it will indirectly form students' independence in learning (Riyadi & Sudiyatno, 2023). Students are required to be able to adapt and be ready to face the challenges and competency needs of a dynamic future by having many skills (Anthonysamy et al., 2020).

The learning process consists of five communication components, namely the teacher as communicator, learning materials, learning media, students as communicants, and learning objectives (Wirawan et al., 2018). Learning media is really needed by teachers and students during the learning process. The learning process has changed from conventional to digital due to technological developments (Ismail et al., 2017). Conventional learning makes students pay less attention to lessons and makes students quickly feel bored with learning and ultimately has an impact on student learning outcomes (Ayu et al., 2022). Therefore, interactive learning media are needed that utilize technology to attract students' attention in learning.

Based on the 21st century learning framework, the learning process is carried out with 4C: Communication, Collaboration, Critical thinking in problem solving, and Creativity and innovation (Basori et al., 2023). The learning process is a communication process between information sources and information recipients (Hidayat et al., 2018). The communication process in learning will not occur or will be less than optimal without learning media (Sukoco et al., 2014). Learning media is a component or learning communication tool to assist teachers in conveying information related to learning material to students as recipients of the information. Accuracy in selecting learning media will influence learning outcomes and student participation during the learning process (Ayuni, 2022).

Technological progress cannot be predicted (Gustiana et al., 2023). The use of digital technology is increasingly widespread, including in the world of education (Suryantoro et al., 2024). Learning media that uses the latest technology really needs to be developed for distance learning (Solikin et al., 2022). The learning media needed during distance learning is learning media that can help students learn independently and be flexible in its use, anytime and

anywhere(Nurjanah & Suprihatin, 2023). One effort to improve the quality of learning is by using interesting learning media with the aim of providing visualization and easy transfer of material from teachers to students (Suyitno, 2016). Distance learning requires students to learn actively and independently, therefore interactive learning media is really needed. Interactive learning media is a learning media that can interact with users/students actively (Surjono, 2017). Learning media can increase students' motivation, interest and enthusiasm for learning(Ghofur, 2022).

Almost all students have smartphones, because it makes it easier to access practical information and is easy to carry everywhere (Isfaniari et al., 2022). Because in the current era, smartphones have become a basic need for everyone for social and interaction needs (Triatmaja et al., 2021). Currently, smartphone technology is increasingly being used for educational purposes (Syamsuni et al., 2022). Learning using smartphones is usually called mobile learning. Mobile learning is a form of learning development that is growing rapidly in the current digital era. Learning media arranged in digital format can attract and motivate users to learn (Anas, 2019). So the impact of technology on the world of education is marked by the emergence of many applications equipped with learning materials in the form of Android applications (Sefriani et al., 2022). Android is an operating system that is widely used on smartphones which can be used for communication and makes work easier, including in the field of education (Rohmah et al., 2023). The Android operating system is open source and has multitasking capabilities to run many applications on smartphone devices (Basori et al., 2018). Android provides an open platform for developers to create their own applications (Hardiansyah, 2018).

One of the Automotive Engineering Skills Program in class XI Vocational High Schools is studying vehicle electrical maintenance. One of the competencies that must be mastered is the vehicle instrument panel. The vehicle instrument panel is an interface device that connects the driver with the vehicle's electrical and mechanical systems (Sumantri et al., 2018). The instrument panel on the vehicle provides information regarding the active or non-active mode of the vehicle's features, so that drivers need a new understanding, process and awareness of the vehicle control system (Rudiyanto et al., 2019).

Competence in vehicle instrument panels is sometimes considered unimportant because it only involves learning about the panel symbols on the vehicle. In fact, it is quite important because the vehicle instrument panel is the main component of visual interaction between the driver to determine the condition of the vehicle regarding vehicle speed, engine speed, engine temperature, battery charging system, engine cooling system, fuel tank contents, and other special features available on the vehicle. Each vehicle has a different instrument panel, depending on the features

the vehicle has. Teachers will have difficulty using conventional learning because each vehicle has a different instrument panel, so technology-based learning media is needed that contains a collection of instrument panel symbols from various types of vehicles.

There are several types of learning technologies that are currently developing such as: Quizizz, Kahoot!, Google Classroom, Google Meet, Zoom, Video, E-Book, E-Learning, Learning Applications, and so on. In this study, we will develop learning media based on Android Applications because this learning media can interact with media users without requiring internet access so that it can be accessed anywhere and anytime, does not require large smartphone storage, and the application not only contains learning materials but also interesting quiz for learning evaluation.

The aim of developing this media is to summarize all the material on vehicle instrument panels in all vehicles in the form of Android application learning media. The learning media developed can be used for distance learning needs. The learning media developed is interactive because students as media users can interact directly with the media, thus enabling students to learn independently anytime and anywhere.

Method

The research method used in this research is research and development (RnD). Research and development is a research method that produces a particular product and tests whether a product is effective or not (Sugiyono, 2011). Android application learning media products that are developed need to be checked for quality or the level of product suitability by means of validation. Validity is a measure that shows the level of validity (Arikunto, 2013). Validation in this research was carried out by material experts and media experts. Validation by material experts aims to measure the level of suitability of learning media in terms of the material that has been presented, while validation by media experts aims to measure the level of suitability of learning media in terms of media, both in terms of function and media appearance design. After going through the validation stage, the product will then be tested on the research subjects, namely all 28 students of class XI in the Automotive Engineering Skills Program at SMK PIRI 1 Yogyakarta and are currently taking the light vehicle electrical maintenance subject.

Research data was obtained from material experts, media experts, and students through assessment questionnaires. This research data is in the form of scores using a Likert scale. The Likert scale is used to measure opinions, attitudes and perceptions of a person or group (Sugiyono, 2011). In this research, the Likert scale used has 4 scales, namely: very feasible, feasible, not feasible, and very not feasible. Then the data scores need to be converted into values according to the assessment criteria. According to Arikunto (2013), there are four categories of assessment criteria. In this study,

the researcher adapted this opinion and the following are the results of the assessment criteria:

Table 1. Table captions should be placed above the table

Category Score Interval	*Category*
Mi + 1,50 SDi < X ≤ Mi + 3 Sdi	Very Feasible
Mi < X ≤ Mi + 1,50 Sdi	Feasible
Mi - 1,50 SDi < X ≤ Mi	Not Feasible
Mi - 3 SDi < X ≤ Mi – 1,50 Sdi	Very Not Feasible

Information :

Mi = Ideal average

Mi = $\frac{1}{2}$ x (Ideal Highest Score + Lowest Score is Ideal)

Sdi = Ideal standard deviation

SD = $\frac{1}{6}$ x (Ideal Highest Score + Lowest Score is Ideal)

The results of the feasibility level assessment in the table above will be a reference for assessing the feasibility of the assessment results by material experts, media experts and students. The score results obtained will indicate the level of feasibility of Android application-based learning media on vehicle instrument panel competency.

Result and Discussion

The development model used to develop learning media based on this Android application is ADDIE. ADDIE is an abbreviation for Analysis, Design, Development, Implementation and Evaluation (Mulyatiningsih, 2011). The reason for choosing to use the ADDIE development method is because this development model is quite simple, but has advantages in its systematic and structured work stages. The ADDIE model approach is effective for developing vocational learning media because each step in the development that will be passed always refers to the previous step that has gone through a process of improvement or revision, so that interesting learning media products can be obtained for vocational learning. Research conducted by Setiawan & Muchlas (2021) succeeded in developing Android-based educational game media using the ADDIE development model and the products developed can effectively support learning.

The development of learning media on vehicle instrument panel competency based on an Android application uses five procedural stages, namely:

Analysis

The analysis stage in this research was to conduct learning observations on the subject of vehicle electrical maintenance at SMK PIRI 1 Yogyakarta. Based on the results of observations, it is known that SMK PIRI 1 Yogyakarta does not have vehicle instrument panel learning media, the learning method used is discovery learning, and many students do not follow the learning process optimally.

Apart from conducting learning observations, this research also conducted interviews with teachers who teach vehicle electrical maintenance subjects at SMK PIRI 1 Yogyakarta to determine basic competencies and learning objectives that will be used as learning media. The results of interviews related to basic competencies and learning objectives can be seen in Table 2 below:

Table 2. Basic Competencies and Learning Objectives

Basic Competencies:
Implement maintenance methods for lighting systems and instrument panels
Learning objectives:
1. Understand the definition of the instrument panel on a vehicle.
2. Understand the types of instrument panels on vehicles.
3. Understand the meaning of the symbols on the vehicle instrument panel indicators.
4. Understand how the vehicle instrument panel works.
5. Carry out maintenance on the vehicle instrument panel.

Design

Navigation design which aims to determine the structure of the learning media program. Navigation design in making learning media is very important, because it makes it easier to operate the learning media so that users can easily master the use of the learning media.

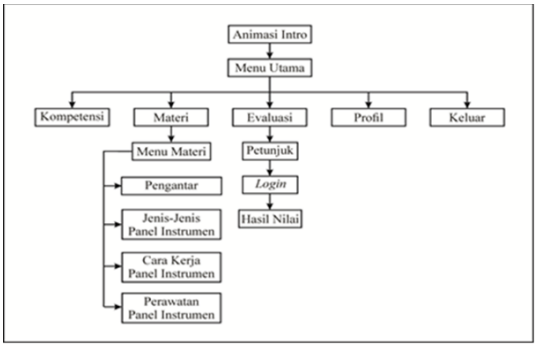

Fig 1: Navigation Design

Display design (User Interface) aims to determine the appearance of graphic designs that relate directly to users, so that users can interact and be more interested in the content of learning media material.

Fig 2: Display Design

Algorithm design that aims to determine work flow and work orders in learning media. Workflow and work orders function to move a page display to another page display, thereby determining the functionality of the learning media. Algorithm design is carried out in the form of a flowchart.

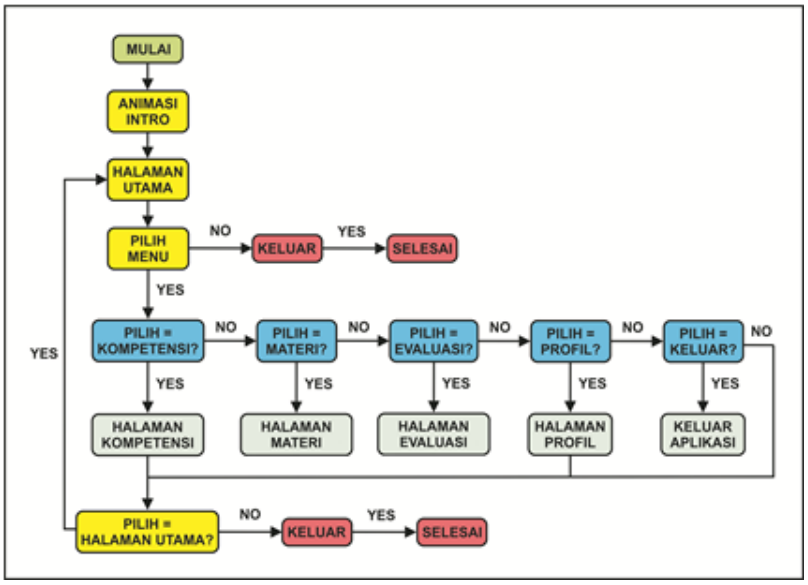

Fig 3: Algorithm Design

Development

The process of creating Android-based learning media products at the development stage uses assistance from Adobe Flash Professional CS6 software to produce media files in APK format and Adobe Photoshop software to design the application logo, design the appearance of the application,

and edit images. The results of product development in this research are as follows:

On the main menu there is an application menu with 5 buttons, namely competency, material, evaluation, profile and exit buttons. The display of the main menu can be seen in Figure 4.

Fig 4. Application Main Menu Display

The competency page contains basic competencies and learning objectives that students must master. The display of the competency menu can be seen in Figure 5.

Fig 5. Application Competency Menu Display

In the material menu there are 5 buttons, namely the introduction button, types, how it works, and maintenance. In order for media users to more quickly understand the content of the material in learning media, the learning material is presented in the form of text and images. The appearance of the material menu can be seen in Figure 6 and Figure 7.

Fig 6. Application Material Menu Display

Fig 7. Material Contents Display

To measure the achievement of learning objectives, evaluation questions are needed on learning media applications. The evaluation consists of 20 questions, questions that have been done cannot be repeated, a temporary score will appear after answering the questions, and evaluation results will appear after all 20 questions have been answered. The following are the results of the question work instructions display, the evaluation login display, the evaluation question display, and the evaluation results display which can be seen in the image below:

Fig 8. Display of Question Working Instructions

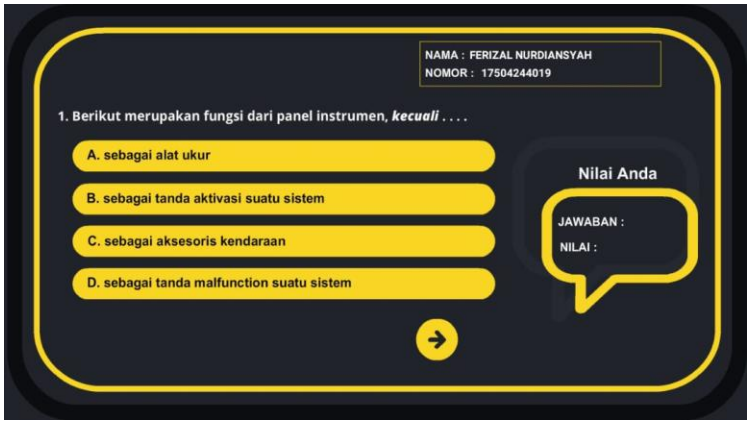

Fig 9. Evaluation Question Display

Fig 10. Evaluation Results Display

After the learning media creation process, the Android application learning media product being developed needs to be checked for quality or product suitability level by means of validation. Validation is carried out by material experts and media experts. Validation by material experts aims to measure the level of suitability of learning media in terms of the material that has been presented, while validation by media experts aims to measure the level of suitability of learning media in terms of media, both in terms of function and media appearance design. The following are the validation results from material experts and media experts:

Material validation was carried out by 2 validators. Material validation was carried out by Lecturers in the Department of Automotive Engineering Education, FT UNY as Validator 1 and Teachers in the Department of Automotive Engineering Skills Program at SMK PIRI 1 Yogyakarta as Validator 2. Validation tests by material experts consisted of several aspects of assessment, namely aspects of material relevance, evaluation aspects, and benefit aspect. The results of the validation tests carried out by material experts can be seen in Table 3 below:

Table 3. Validation Test Results by Material Experts

No.	*Rated aspect*	*Validator 1*	*Validator 2*	*Average Score*	*Category*
1	Relevance of Material	30	26	28	Very Feasible
2	Evaluation	24	23	23,50	Very Feasible
3	Benefit	15	14	14,50	Very Feasible
4	All Aspects of the Material	69	63	66	Very Feasible

Media validation is carried out by 2 validators. Media validation was carried out by a Lecturer in the Department of Automotive Engineering Education, FT UNY as Validator 1 and a Teacher in the Department of Automotive Engineering Skills Program at SMK PIRI 1 Yogyakarta as Validator 2. The validation test by media experts consisted of several assessment aspects, namely software

engineering aspects, language aspects, and visual appearance aspects. The results of the validation tests carried out by media experts can be seen in Table 4 below:

Table 4. Validation Test Results by Media Experts

No.	Rated aspect	Validator 1	Validator 2	Average Score	Category
1	Software engineering	19	19	19	Very Feasible
2	Language	16	16	16	Feasible
3	Visual Display	30	26	28	Feasible
4	All Aspects of Media	55	51	53	Very Feasible

Implementation

The level of feasibility of the learning media being developed can be measured and known through the implementation stage. At this implementation stage, it was tested on all 28 students of class XI in the Automotive Engineering Skills Program at SMK PIRI 1 Yogyakarta and are currently taking the light vehicle electrical maintenance subject. The results of user trials by students can be seen in Table 5 below:

Table 5. User Test Data Results

No.	Rated aspect	Total Score	Average Score	Category
1	Learning materials	424	15,14	Feasible
2	Visual Display	501	17,89	Feasible
3	Media Benefits	398	14,21	Feasible
4	All Aspects of Assessment	1324	47,25	Feasible

In addition to measuring the level of eligibility of the learning media that has been developed, it is necessary to conduct a pretest and posttest. Pretest and posttest are two types of tests used to evaluate the effectiveness of learning media, with a pretest at the beginning of learning to measure students' initial knowledge, and a posttest at the end to measure understanding after using the learning media. The results of the pretest and posttest can be seen in the image below:

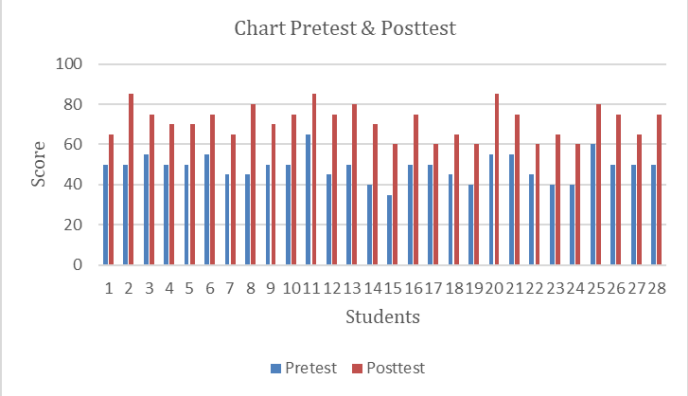

Fig 11. Pretest and Posttest Results

Evaluation

After receiving comments, suggestions or improvements from material experts and media experts, it is necessary to revise the product with the aim of ensuring that the learning media being developed gets maximum results. The following are the results of product revisions based on comments, suggestions or improvements from material experts and media experts:

The final average score from material experts was in the "very feasible" category, however in order for Android application-based learning media to be more suitable for use as learning media, the researchers revised the product based on comments, suggestions or improvements from material experts. There were changes to the learning objectives, the writing of the learning objectives was changed because the learning objectives did not meet the ABCD elements (Audience, Behavior, Condition and Degree) and did not use operational language. In the section on classification material or types of vehicle instrument panels, there is an error in the use of words, so it is necessary to revise the words working principle to change to working mechanism. In the how-to section there are no image illustrations, therefore it is necessary to add image illustrations with balanced image proportions so that users can more easily understand the content of the material. In the instrument panel maintenance section, the material is still very minimal, therefore revisions need to be made in the form of additional material. Before the revision there were only 2 maintenance steps totaling 2 pages, after the revision there were 3 maintenance steps totaling 5 pages. In the evaluation section, the types of questions given are included in the C1 cognitive domain, namely about knowledge/memorization/memory (knowledge), so the questions are still too easy to answer. Because it is necessary to revise the types of questions to change to the C4 cognitive domain, namely analysis, so that it trains students' way of thinking to search for and find causal relationships in a problem.

The final average score from media experts received the "very feasible" category, however in order for Android application-based learning media to be more suitable for use as learning media, the researchers revised the product based on comments, suggestions or improvements from media experts. There is a change in font size, especially in the material section. The previous font size was 17 pt, but after revisions were made the font size became 20 pt with the aim of increasing the font size to make it easier and increase user comfort in reading learning material in the media. Apart from changes in font size, there are also changes in image size. The image size on the media is too small, making it difficult for users to understand the material in the media, therefore it is necessary to revise the image size to be larger.

Conclusion

Based on research data on the development of interactive learning media based on android applications, it can be concluded that an android application-based learning media product has been created that has been tested for its feasibility. The vehicle instrument panel competency learning media based on the android application obtained the category of "very feasible" according to material experts because it obtained an assessment score of 66 with a maximum score of 76, the category of "very feasible" according to media experts because it obtained an assessment score of 53 with a maximum score of 64, and the category of "feasible" according to students of SMK PIRI 1 Yogyakarta because it obtained a score of 47.25 with a maximum score of 64.

The resulting product has a good learning influence, namely it can increase the effectiveness of vehicle instrument panel learning for vocational school students with automotive engineering skills program. The development of this learning media can be developed further by integrating it into the vocational school curriculum, and it is highly recommended to use a blended learning approach or combine face-to-face and digital learning in order to obtain maximum student learning outcomes.

References

Anas, L. (2019). Pengembangan Sistem Aplikasi Multimedia Interaktif Pada Pelajaran (Fisika Energy) Untuk Tingkat Sekolah Menengah Atas. JTP - Jurnal Teknologi Pendidikan, 21(1), 24–41. https://doi.org/10.21009/jtp.v21i1.10570

Anthonysamy, L., Koo, A. C., & Hew, S. H. (2020). Self-regulated learning strategies in higher education: Fostering digital literacy for sustainable lifelong learning. Education and Information Technologies, 25(4), 2393–2414. https://doi.org/10.1007/s10639-020-10201-8

Arikunto, S. (2013). Prosedur Penelitian Suatu Pendekatan Praktik. Edisi Revisi. PT. Rineka Cipta.

Ayu, Y., Wahyuningtyas, P., Fikri, K., & Fitrianawati, M. (2022). Dampak Pembelajaran Konvensional Pada Siswa SD Muhammadiyah Domban 3 dan Problem Based Learning Sebagai Solusinya. https://seminar.uad.ac.id/index.php/semhasmengajar/article/viewFile/10723/pdf

Ayuni, N. W. D. (2022). Interactive Animation Learning Media on Android as a Creative Learning in Regression Analysis Topic. JTP - Jurnal Teknologi Pendidikan, 24(1), 9–22. https://doi.org/10.21009/jtp.v24i1.22567

Basori, B., Isnaini, R., Setyowati, A., & Phommavongsa, D. (2018). Development of an Android-Based Reward System to Enhance the Activity of Learning. Jurnal Pendidikan Teknologi Dan Kejuruan, 24(1), 116–124. https://doi.org/10.21831/jptk.v24i1.18088

Basori, B., Sajidan, S., Akhyar, M., & Wiranto, W. (2023). Analysis Of Vocational Students' Critical Thinking Skills Using The OER-Assisted Blended Learning. Journal of Innovation in Educational and Cultural Research, 4(2), 264–270. https://doi.org/10.46843/jiecr.v4i2.566

Ghofur, A. (2022). Digital Comic Media on Smartphones to Improve Communication Skills. Journal of Innovation in Educational and Cultural Research, 3(3), 432–444. https://doi.org/https://doi.org/10.46843/jiecr.v3i3.149

Gustiana, A., Yulia, C., & Joshua, Q. (2023). Development of a Mobile Menu Book as a Media For Learning Food Service in Tourism Schools. Journal of Vocational Education Studies, 6(2), 214–225. https://doi.org/10.12928/joves.v6i2.8654

Hardiansyah, A. (2018). Designing Android Based Augmented Reality Location-Based Service Application. Jurnal Online Informatika, 2(2), 110. https://doi.org/10.15575/join.v2i2.115

Hidayat, N., Hadi, S., Basith, Abd., & Suwandi, S. (2018). Developing E-Learning Media with the Contiguity Principle for the Subject of Autocad. Jurnal Pendidikan Teknologi Dan Kejuruan, 24(1), 72–82. https://doi.org/10.21831/jptk.v24i1.17796

Isfaniari, Inayah, Fiyerni, L., & Musdiani. (2022). Peran Orangtua pada Penggunaan Smartphone oleh Siswa SD Negeri Lampageu Kecamatan Peukan Bada Kabupaten Aceh Besar. https://eproceeding.bbg.ac.id/tekad/article/download/27/23

Ismail, M. E., Masran, S., Rahim, M., Faizal, A., & Marian, M. (2017). Development of Electrical Discharge Machine Die Sinking Application Using Android Platform. Jurnal Pendidikan Teknologi Dan Kejuruan, 23(4), 340–343. https://journal.uny.ac.id/index.php/jptk/article/view/12825

Mulyatiningsih, E. (2011). Metode Penelitian Terapan Bidang Pendidikan. Alfabeta.

Nurjanah, F., & Suprihatin, S. E. Y. (2023). The development of Android-based learning media using Kodular in making suit patterns subject. Jurnal Pendidikan Vokasi, 13(3), 232–245. https://doi.org/10.21831/jpv.v13i3.54542

Riyadi, A., & Sudiyatno, S. (2023). The impact of online learning on students learning motivation. Jurnal Pendidikan Vokasi, 13(1), 36–43. https://doi.org/10.21831/jpv.v13i1.46568

Rohmah, F., Rusilowati, A., Supriyadi, S., & Widowati, T. (2023). Validitas dan reliabilitas instrumen penilaian berbasis android untuk menilai kemampuan siswa SMK dalam mendesain busana secara digital. JPPI (Jurnal Penelitian Pendidikan Indonesia), 9(2), 577. https://doi.org/10.29210/020232131

Rudiyanto, F. S., Sachari, A., & Sabana, S. (2019). Struktur Visual Ikon Autopilot Panel Instrumen

Kendaraan Autonomous Level-3. 93–98. https://jurnal.tau.ac.id/index.php/snartek/article/view/104/72

Sari, N. K. D. P., & Wiyasa, I. K. N. (2021). Development of Interactive Learning Multimedia Indonesia's Cultural Diversity Material in Social Sciences Learning for Grade IV Elementary School Students. Journal of Education Technology, 5(1), 48. https://doi.org/10.23887/jet.v5i1.32053

Sefriani, R., Sepriana, R., Radyuli, P., & Hakiki, M. (2022). Android-Based Blended Learning Media for Computer Maintenance Lectures. Journal of Education Technology, 6(1), 119–125. https://doi.org/10.23887/jet.v6i1.42514

Setiawan, H. W., & Muchlas, M. (2021). Development of Using Blended Learning Education-Based Game Learning Media Android for Students Basic Electronics. Journal of Vocational Education Studies, 4(2), 237–248. https://doi.org/10.12928/joves.v4i2.4645

Solikin, M., Yudianto, A., & Adiyasa, I. W. (2022). The Development of Learning Media of 2-Stroke Engine Manufactured by 3D Print for Distance Learning. Jurnal Pendidikan Teknologi Dan Kejuruan, 28(1), 121–129. https://doi.org/10.21831/jptk.v28i1.47499

Sugiyono. (2011). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Afabeta.

Sukoco, Arifin, Z., Sutiman, & Wakid, M. (2014). PENGEMBANGAN MEDIA PEMBELAJARAN INTERAKTIF BERBASIS KOMPUTER UNTUK PESERTA DIDIK MATA PELAJARAN TEKNIK KENDARAAN RINGAN. Jurnal Pendidikan Teknologi Dan Kejuruan, 22(2), 215–226. https://journal.uny.ac.id/index.php/jptk/article/view/8937

Sumantri, B., Abimayu, A., & Tamami, N. (2018). Sistem Portable Dashboard Berbasis Android untuk Mobil Listrik. Jurnal Rekayasa Elektrika, 14(3). https://doi.org/10.17529/jre.v14i3.11826

Surjono, H. D. (2017). Multimedia Pembelajaran Interaktif: Konsep dan Pengembangan, Edisi Pertama. UNY Press.

Suryantoro, S. A., Muchlas, M., & Santosa, B. (2024). Use of Digital Learning Management Systems for Enhancing Cognitive Achievement in Vocational Productive Course. Journal of Vocational Education Studies, 7(1), 126–136. https://doi.org/10.12928/joves.v7i1.10360

Suyitno, S. (2016). Pengembangan Multimedia Interaktif Pengukuran Teknik untuk Meningkatkan Hasil Belajar Siswa SMK. Jurnal Pendidikan Teknologi Dan Kejuruan, 23(1), 101. https://doi.org/10.21831/jptk.v23i1.9359

Syamsuni, Hairuddin, & Elli. (2022). The Application of Learning Model (Google and Google Form)

Based Android toward Studentsâ€TM Activities and Research Methodology Learning Outcomes. Journal of Innovation in Educational and Cultural Research, 3(3), 294–300. https://doi.org/10.46843/jiecr.v3i3.95

Triatmaja, A. K., Probosiwi, Oktavian, W. F., & Sudarma, R. T. (2021). Developtment Virtual Laboratory of Digital Electronics Using Mobile Virtual Reality. JOVES, 4(2), 277–285. https://doi.org/10.12928/joves.v4i2.5742

Wirawan, I. M. A., Sunarya, I. M. G., Jayendra, I. G. N. T., & Yudianto, A. (2018). Mobile Learning Based on Guided Inquiry: Optimization of Students' Motivation. Jurnal Pendidikan Teknologi Dan Kejuruan, 24(2), 256–261. https://doi.org/10.21831/jptk.v24i2.20651

Wiryanto, W., Suprayitno, S., & Primaniarta, M. G. (2024). Implementation of Emergency Curriculum in Local Wisdom Contents at Television as a Learning Media During the Pandemic Period. Journal of Innovation in Educational and Cultural Research, 5(2), 218–228. https://doi.org/10.46843/jiecr.v5i2.1071