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Validity of interactive learning media in computer basics course

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ABSTRACT

This study aims to determine the validity and practicality of interactive media in computer basics courses in the educational technology study program at Universitas Kristen Indonesia Toraja. This type of development research uses the ADDIE research model (Analysis, Design, Development, Implementation, and Evaluation). The results of the validity and practicality tests can be used as a reference for assessing the media that has been developed. This research has conducted a content validity test; the quality of interactive media based on the assessment by teaching material expert lecturers shows an average of 3.77 from a maximum average score of 4.00. Thus, interactive media shows criteria worth using. The results of the media validity test that the quality of interactive media based on the assessment by media expert lecturers shows an average of 3.58 from a maximum average score of 4.00; thus, the module indicates very feasible criteria. The interactive media practicality test results showed that the interactive media developed an average of 3.46 from an average score of 4.00. Thus, the module showed efficient criteria.

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INTRODUCTION

Technology development is getting faster and faster, especially information and communication technology. This makes humans seem inseparable by distance, space, and time. With the development of increasingly advanced technology, humans can make various kinds of equipment as tools in multiple activities to support productivity. The existence of rapid technological growth today will continue to produce new patterns in learning and encourage rapid adaptation. In the learning process, the use and utilization of technology in the classroom have become a necessity and a demand in the global era (Rijal, 2021). This era is often called the digital era (Alami, 2020). Along with these developments, in this case, smartphones. Indonesia is one of the countries with the world's most significant active smartphone users. Educators can use the high number of smartphone users as a medium for delivering learning. Learning media is an intermediary that can convey messages or information.

They are learning to students from an educator. One of them, an essential element of education in the learning process that must follow the flow of technological developments, is

learning media (Salsabila & Aslam, 2022). In connection with that, teaching media is also a tool that explains part of the entire learning program that is difficult to explain verbally (Aroni, 2019). Technological advances to support education like this can make it easier for anyone, both students and educators, to increase knowledge without limits (Cecep et al., 2019; Chen & Tsai, 2021; Rorita et al., 2018). Educators and students can directly feel the positive things of optimizing smartphones in education: supporting educational development (H. et al., 2021; Sunismi, 2015). One of the efforts to increase the effectiveness of the learning process and delivery of lesson content is using learning media (Lestari et al., 2019). Several studies have generally focused on teaching models, methods, activities, and evaluations of specific teaching and learning subjects (Zheng & Xie, 2016).

Technology has been applied to daily life, especially in education. Now, technology is used to help their work and efforts to be more effective and efficient (Pratama et al., 2022). So, in this digital era, using technology is an additional competency that must be owned and mastered by an educator (Purnasari & Sadewo, 2021). Along with information and communication technology, learning media has also developed. One of the technology-based media is mobile learning. Mobile learning developed due to the development of communication technology, namely smartphones. Android is a smartphone operating system that is currently popular (Ardiansyah & Nana, 2020). Seeing the development of technology among students, especially in the relatively high use of smartphones, it is just that educators still need to fully utilize it in the learning process (H. et al., 2021). In the 21st century, learning media, commonly called digital media, is needed along with technological developments to support teaching and learning (Shoffa et al., 2021). Educators can use many Android-based software to make supporting media in the classroom learning process, including the SAC (Smart App Creator) software. Smart App Creator (SAC) is one of the software to create androiAndroidOS- bIOS-based cations without using programming code, and the output is HTML5, .exe, and .apk. The use of software in making learning media without programming code makes it easy for anyone to create applications quickly, readily ally for educators who want to make applications related to learning media.

The findings show that using technology as a learning medium is limited to using presentation media to deliver material. Computer basics is a course with a structure that must be described and the concrete form of computer elements. The media used by educators in providing learning materials are whiteboards, markers, printed modules, and PowerPoint. Ed, educators have used information and communication technology-based media, but the use of these media still needs to be improved because the PowerPoint used only contains material delivery in the form of images and text; there is no time, simulation, or evaluation. So, learning media is required to display text, photos, videos, animations, simulations, and assessments to improve student understanding. With the variation in the use of various media in the learning process, it is intended to carry out an effective and efficient learning process. Classroom learning time is also limited while the speed of student learning varies from one to another, the condition of the learning process. This can undoubtedly hinder the learning process, so supporting learning media is needed that can be used by students with different learning speeds (Fadli & Hakiki, 2020). Learning media can help the process of learning activities that aim to clarify the delivery of learning meaning so that learning objectives can be delivered more perfectly and well (Temitayo et al., 2013).

Educators must design media covering course concepts in theory, illustrations, and concrete examples. Learning media can also improve the quality of learning for educators to help deliver innovative, creative, comprehensive learning materials, attract students' enthusiasm, and create a pleasant learning situation. Educators must be able to start learning conditions to make students easily understand the material by utilizing technology that can produce learning media, especially for computer basics courses. It is necessary to encourage renewal in learning so that learning is easy to use, interactive, packaged more interestingly, and becomes something new for students by utilizing technology (Muttaqin et al., 2021). Therefore, there is a need for innovation in learning to increase students' interest in learning and motivation to learn. Many types of media can be used by educators in the teaching and learning process, but educators must be selective in choosing these types of media (Hasan, 2021). There is a need to develop interactive learning media based on Android applications to optimize popular smartphone features among students.

Interactive media is designed to provide feedback quickly as the media allows interaction with users so that users can choose what they want for the next step (Myori et al., 2019). Researchers chose Smart App Creator (SAC) software because creating learning media, especially interactive media, is more accessible. It can add animation and sound backgrounds to make media content more engaging. Android is an operating system for Linux-based mobile devices, including an operating system, middleware, and applications. Android provides an open platform for developers to create their applications. Android is the operating system that powers over one billion smartphones and tablets (Putra et al., 2016). So, android-based interactive media can overcome the problem of differences in students' level of understanding because students can choose the material they will learn. The ability of Android to display multimedia, such as images, photos, videos, sound, and text simultaneously, can be utilized to display learning material more concretely so that learning is not boring (Ahyar et al., 2014; Aina, 2013). Computer utilization is often used in interactive multimedia because it contains several media such as text, graphics, audio, animation, and video. It is equipped with user control tools as controllers to adjust elements according to user needs (Dewi, 2018). Interactive means mutual influence with a reciprocal relationship between the user and the program, with the user responding to the program request/display, then the program presents the desired information (Ananta & Waryanto, 2018).

Interaction by students through the buttons available in the program can provide a direct learning experience (Anggraini & Sartono, 2019). Interactive multimedia is a technological innovation that can be tailored to learning needs (Arham & Dwiningsih, 2016). Interactive education can make students more interested in learning from anywhere and anytime. Android-based interactive media, as an innovative media, has the potential to become a learning trend in today's digital era. Interactive multimedia like this can provide a pleasant learning atmosphere and foster student independence, making the learning process more meaningful than the lecture method (Monemi et al., 2017). Based on the phenomena described, the researcher is interested in researching Interactive Learning Media Development in Computer Basics courses. Validity testing and interactive media practice contribute to how feasible, effective, and efficient it is in helping students take computer basics subjects.

METHOD

This research is a type of development research. The accuracy of the selection of the development model makes the right product. One of the characteristics of the developed product is that it can be appropriately applied and provide benefits to its users. One of the media that considers the primary stages of media development design that is simple and easy to understand is the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Branch, 2010). The ADDIE model is the suitable model for media development in this study because the ADDIE model is most commonly used for media development (Cahyadi, 2019). The research procedure on the ADDIE model is as follows:

Analysis

The first stage is the Analysis stage. This stage is carried out using observation and interview methods.

Design

This stage is known as creating a product design (blueprint). This stage will produce the user interface of the product design. The researcher determines the media elements by collecting supporting materials such as images, animations, sounds, and videos. The collection can be done by searching the internet or making your own media if you master it.

Development

The stage of producing the design that has been made is realized in natural form. The products are arranged according to the invention made in the previous step. This means that this stage is the stage in making the product. The product design is designed with SAC (Smart App

Creator) software. Elements collected in the design stage are assembled into a complete product unit per the user interface created in the design stage.

Implementation

The fourth stage is implementation. This stage tests the product made in terms of product appearance or functionality.

Evaluation

Evaluation checks whether the developed product is successful and as expected based on existing needs. If there are things that need to be improved, they need to be identified and then refined. The goal is to produce a quality product.

The data collection techniques used in this research are questionnaires, documentation, and interviews. An interview, often called an interview or oral questionnaire, is a dialog conducted by an interviewer to collect information from sources (Arikunto, 2006). The documentation method in this research is used to complement data from interviews and observations. The documentation method is a data collection technique by studying data that has been documented. From the origin of the word, documentation, namely documents, means written items (Arikunto, 2006).

The subjects of this research were students of the educational technology study program in the first semester of the 2022/2023 academic year at the Indonesian Christian University of Toraja. The instrument consists of questionnaires for media experts, material/content experts, and users (lecturers and students). Questionnaires were given to media experts and material/content experts to determine the feasibility of interactive media. Questionnaires are also provided to users (students) to find out the user's response to the interactive media that has been developed (Riduwan, 2012). They are using scoring, which can be seen in Table 1.

Table 1. Validity Scoring

No.	Score	Criteria
1	4	Strongly Agree
2	3	Agree
3	2	Disagree
4	1	Strongly Disagree

The validator provides advice on the assessment given to developing interactive media based on the items in the validity test with score criteria, which can be seen in Table 1. Suppose many things still need to be corrected in developing printed and non-printed teaching materials. In that case, revising them to make them valid for the teaching materials developed is necessary.

Table 2. Criteria for assigning validity scores

No.	Average Score	Criteria	Category
1	3.0 < M < 4.0	Very Feasible	Very Practical
2	2.0 < M < 3.0	Worth	Practical
3	1.0 < M < 2.0	Less Feasible	Less Practical
4	0.0 < M < 1.0	Not Feasible	Not Practical

Validity testing by validators who are experts in their fields so that they can measure the level of feasibility of interactive media that has been created (Nurdin, 2007). User response data is obtained from a response questionnaire to the interactive media that has been developed which can be seen in Table 2. The analysis was conducted to determine the response to the Android-based interactive press. The results of user response observations were analyzed to determine the frequency of practicality (Azwar, 2012).

RESULTS AND DISCUSSION

Results

Based on several research models that have been mentioned, the ADDIE research model. Branch felt that it was more suitable for developing this interactive media product. Analysis of a Problem and Needs in Learning Based on the results of the literature study conducted by researchers, data related to learning problems in computer basics courses were obtained, including limited learning media, monotonous delivery of computer basics material, and student's involvement in the learning process that has not been maximized. The results of this study indicate that the computer basics course requires interactive media that can provide concrete evidence related to learning material.

Developing a learning product goes through systematic stages and several feasibility tests to produce valuable user outcomes. It is a very complex and complete model (Branch, 2010). The ADDIE model can be used for various forms of product development in learning activities, such as models, learning strategies, learning methods, media, and teaching materials (Mulyatiningsih, 2016). Interactive media is a media equipped with a controller the user can operate to choose what is desired for the following process (Daryanto et al., 2014). One of the stages in developing media is validating to determine the feasibility level of the media that has been created.

Content Validity

The validity test is carried out to determine the extent of the feasibility of the media that has been designed. After obtaining a feasibility assessment, the learning media is revised according to the validator's criticisms and suggestions. Material expert validators are experts in their fields; material expert validation is a validator who is a lecturer in the Educational Technology Study Program who has expertise in the area or material raised by researchers in the research conducted. The following are the results of material validation by material expert validators:

Table 3. Material Expert Validation Results

No.	Description	Score
1	Clarity of Purpose	4
2	Accuracy of Chapter Titles With Material Content in Each Chapter	4
3	Encourage Students to be actively Involved	4
4	Appropriateness of Learning Objectives with Material Exposure	4
5	Clarity of Material Description	4
6	Clarity of The Examples Provided	3
7	Appropriateness Between Images/Illustrations and Material	4
8	Clarity of Tasks and Exercises Provided	4
9	Congruence Between Tasks and Exercises and Material	4
10	Appropriateness of visual and Audio Impressions and Material	4
11	Suitability of end-of-chapter Tests with Learning Objectives	4
12	Language use in terms of use of Indonesian language methods	3
13	Simplicity of sentence structure	3
Average		**3.77**

Based on the data in Table 3, it can be seen that the quality of interactive media based on the assessment by expert lecturers of teaching materials shows an average of 3.77 from a maximum average score of 4.00. Thus, interactive media shows very feasible criteria.

Media Validity

The next stage after designing interactive media is to conduct a validity test. The validity test is carried out to determine the extent of the feasibility of the press that has been created. Information regarding the suitability of learning animation media is applied to two main aspects: the material and the media aspects. After obtaining a feasibility assessment, the learning media is revised according to the validator's criticisms and suggestions. Media expert validators are experts

in their fields; material expert validation is a validator who is a lecturer in the Educational Technology Study Program who has expertise in the area of learning media by interactive media research raised by researchers in the study conducted. Opinions, criticism, suggestions, assessments, and comments from media and material experts will help improve and increase the quality of the learning media being developed. The following are the results of material validation by media expert validators.

Table 4. Media Expert Validation Results

No.	Aspect	Description	Score
1		The App is Easy to Operate	4
2	Physical	Ease of Access to Each Menu	3
3		Installation of Applications on Android Devices is Very Easy	4
	Total		**11**
	Average		**3.67**
4	Compatibility	The font used is Easy	4
5	Selection Font	Selection of Font Size	4
6	Type	Not Using Too Many Font Combinations	3
	Total		**11**
	Average		**3.67**
7		Proper Menu Placement	4
9	View	Proportional Front Layout (Text and Image Layout)	4
10		App Design Gives a Positive Impression	4
	Total		**12**
	Average		**4**
11	Linguistics	The Use of Language in The Application is Standardized	3
	Total		**3**
	Total Score		**14.34**
	Average		**3.58**

Based on the data in Table 4, it can be seen that the quality of interactive media based on the assessment by media expert lecturers shows an average of 3.58 from a maximum average score of 4.00. Thus, the module indicates very feasible criteria.

Practicality of Media

After analyzing the results obtained from the two validators, user trials were then carried out to obtain data on the assessment of the interactive media that had been developed. At this stage, students of the educational technology study program were involved. Based on Figure 1, it can be concluded that the user's response after using the interactive media and filling out the assessment questionnaire obtained an average score of 3.46, meaning that the user's answer is efficient. So, the user's response is very agreeable (VA) to using interactive media in learning.

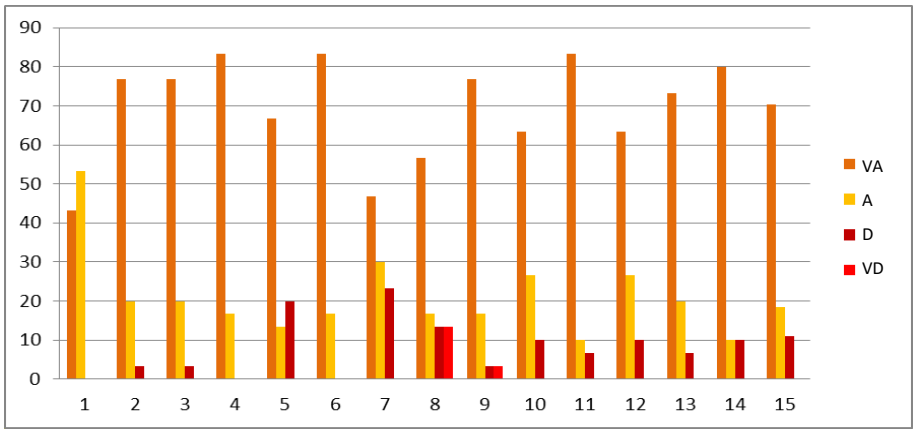

Figure 1. User Response Results

Discussion

This type of development research uses the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). This study only focused on testing the validity and practicality of the interactive media that had been developed. This research is development research with the results of interactive media, which is then carried out several tests to determine the level of feasibility and practicality of the interactive media that has been developed. This study's interactive media development uses Smart App Creator (SAC) software. This feasibility test and suitability of use are carried out to produce interactive media that users can later use according to their learning needs. The subjects of this research were students of the educational technology study program in semester 1 of the 2022/2023 academic year at the Indonesian Christian University of Toraja. The instrument consists of questionnaires for media experts, material/content experts, and users (lecturers and students). Questionnaires were given to media experts and material/content experts to determine the feasibility of interactive media. Questionnaires are also provided to users (students) to find out the user's response to the interactive media that has been developed.

The results of the feasibility test go through two stages, namely, the media feasibility test and the content/material feasibility test. The quality of interactive media based on the assessment by teaching material expert lecturers shows an average of 3.77 from a maximum average score of 4.00. Thus, interactive media shows very feasible criteria. The quality of interactive media based on the assessment by media expert lecturers shows an average of 3.58 from a maximum average score of 4.00; thus, the module indicates very feasible criteria. Based on the results of the practicality test of using interactive media, it can be concluded that the user's response after using interactive media and filling out the assessment questionnaire is 3.46, which means that the user's answer is in a convenient category. So, the user's response is very agreeable to using interactive media in learning. The results of the feasibility and practicality test of the interactive media that has been developed can be a reference to be continued to a broader stage and, in terms of development, can be a reference to grow both in terms of content/material or appearance.

CONCLUSION

Interactive media development uses the ADDIE research model (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model is one of the most complex and complete models for developing interactive media. Interactive media development in this study uses Smart App Creator (SAC) software. This research is development research with the results of interactive media, which is then carried out several tests to determine the level of feasibility and practicality of interactive media that has been developed. The results of the validity test and Practicality can be used as a reference for assessing the press that has been created. This study has conducted a content validity test; the quality of interactive media based on the assessment by teaching material expert lecturers shows an average of 3.77 from a maximum average score of 4.00. Thus, interactive media shows criteria worth using. The results of the media validity test that the quality of interactive media based on the assessment by media expert lecturers shows an average of 3.58 of the maximum average score of 4.00; thus, interactive media shows criteria worth using. The results of the Validity Test of interactive media in computer basics courses regarding material/content and media are very relevant to be developed. Still, some minor revisions must be made for the sake of perfection of the media that has been created. The interactive media practicality test results show that interactive media development leads to 3.46 from an average score of 4.00. Thus, the module shows efficient criteria. The test results in this study can be a reference to be continued to a broader stage and can be developed in terms of content or appearance.

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REFERENCES

Ahyar, R., Lufri, & Ramadhan, S. (2014). Pengembangan multimedia pada materi struktur dan fungsi organ manusia untuk siswa kelas xi sekolah menengah atas. *Jurnal Kolaboratif*, *2*(1), 20–30. https://ejournal.unp.ac.id/index.php/kolaboratif/article/view/4957

Aina, M. (2013). Efektivitas pemanfaatan multimedia interaktif pembelajaran IPA biologi dalam meningkatkan motivasi belajar siswa pria dan wanita SMP 9 Kota Jambi. *Prosiding Semirata FMIPA Universitas Lampung*, *1*(1), 125–130. https://jurnal.fmipa.unila.ac.id/semirata/article/view/597

Alami, Y. (2020). Media pembelajaran daring pada masa covid-19. *Tarbiyatu Wa Ta'lim: Jurnal Pendidikan Agama Islam*, *2*(1), 49–56. https://ejournal.staisyamsululum.ac.id/index.php/jtt/article/view/71%0A

Ananta, A. R., & Waryanto, N. H. (2018). Pengembangan media pembelajaran berbasis multimedia interaktif dengan pendekatan kontekstual materi lingkaran kelas Viii SMP. *Jurnal Pedagogi Matematika - S1*, *7*(4), 1–9. https://doi.org/10.21831/jpm.v7i4.11180

Anggraini, M. S. A., & Sartono, E. K. E. (2019). Kelayakan pengembangan multimedia interaktif ramah anak untuk meningkatkan kemampuan pemahaman konsep dan karakter cinta tanah air siswa kelas iv SD. *Kwangsan*, *7*(1), 57–77. https://doi.org/10.31800/jtp.kw.v7n1.p57--77

Ardiansyah, A. A., & Nana. (2020). Peran Mobile learning sebagai inovasi dalam meningkatkan hasil belajar siswa pada pembelajaran di Sekolah. *Indonesian Journal Of Educational Research and Review*, *3*(1), 47–56. https://doi.org/10.23887/ijerr.v3i1.24245

Arham, U. U., & Dwiningsih, K. (2016). Keefektifan multimedia interaktif berbasis blended learning. *Kwangsan*, *4*(2), 111–118. https://doi.org/10.31800/jtp.kw.v4n2.p111--118

Arikunto, S. (2006). *Prosedur penelitian suatu pendekatan praktek*. PT. Rineka Cipta.

Aroni, H. (2019). Pengembangan Komik sebagai media pembelajaran untuk meningkatkan pengetahuan pesan gizi seimbang (PGS) pada siswa SMP di Kabupaten Malang. *Ilmu Informasi Kesehatan Indonesia (JIKI)*, *5*(1), 33–38. https://doi.org/10.31290/jiki.v5i1.929

Azwar. (2012). *Reliabilitas dan validitas*. Pustaka Pelajar

Branch, R. M. (2010). *Instructional design: The ADDIE approach*. Springer US. https://dx.doi.org/10.1007/978-0-387-09506-6

Cahyadi, R. A. H. (2019). Pengembangan Bahan Ajar Berbasis Addie Model. *Halaqa: Islamic Education Journal*, *3*(1), 35–42. https://doi.org/10.21070/halaqa.v3i1.2124

Cecep, C., Mutaqin, A., & Pamungkas, A. S. (2019). Pengembangan modul Quick Math berbasis Mobile learning sebagai penunjang pembelajaran matematika di SMA. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika*, *7*(2), 148–159. https://doi.org/10.33394/j-ps.v0i0.1761

Chen, C. H., & Tsai, C. C. (2021). In-service teachers' conceptions of Mobile technology-integrated instruction: Tendency towards student-centered learning. *Computers and Education*, *170*(1), 1–13. https://doi.org/10.1016/j.compedu.2021.104224

Daryanto, Dwicahyono, A., & Purwanto, D. (2014). *Pengembangan perangkat pembelajaran (silabus, RPP, PHB, bahan ajar)* (Cet. 1). Yogyakarta Gava Media.

Dewi, C. C. (2018). Pengembangan modul pembelajaran pada kompetensi dasar menerapkan komunikasi bisnis Kelas X Pemasaran di SMK Negeri 1 Jombang. *Jurnal Pendidikan Tata Niaga (JPTN)*, *6*(3), 159–164. https://doi.org/10.26740/jptn.v6n3.p%25p

Fadli, R., & Hakiki, M. (2020). Validitas media pembelajaran interaktif berbasis Android pada mata pelajaran komputer dan jaringan dasar di sekolah menengah kejuruan. *Jurnal Inovasi Pendidikan dan Teknologi Informasi (JIPTI)*, *1*(1), 9–15. https://doi.org/10.52060/pti.v1i1.302

H., N., Gani, H. A., Pratama, M. P., & Wijaya, H. (2021). Development of an Android-based computer based test (CBT) in middle school. *Journal of Education Technology*, *5*(2), 272–281. https://doi.org/10.23887/jet.v5i2.33527

Hasan, M. (2021). *Media pembelajaran*. Tahta Media Group.

Lestari, D., Musadad, A. A., & Wahyuni, S. (2019). Penggunaan Computer based test (CBT) sebagai sarana evaluasi dan pengaruhnya terhadap efektivitas penilaian pada mata pelajaran sejarah Di SMA Negeri 1 Boyolali tahun ajaran 2015/2016. *Candi: Jurnal Penelitian dan Pendidikan Sejarah*, *19*(1), 29–39. https://jurnal.uns.ac.id/candi/article/view/35584/23116

Monemi, R., Lufri, & Leilani, I. (2017). Pengembangan multimedia interaktif berbasis Power Point disertai Games kuis course Maza pada materi sistem ekresi untuk peserta didik kelas Viii SMP. *Journal Biosains*, *1*(2), 252–260. https://ejournal.unp.ac.id/students/index.php/bio/issue/download/355/56

Mulyatiningsih, E. (2016). *Pengembangan model pembelajaran* (pp. 1–8). https://staffnew.uny.ac.id/upload/131808329/pengabdian/7cpengembangan-model-pembelajaran.pdf

Muttaqin, H. P. S., Sariyasa, & Suarni, N. K. (2021). Pengembangan media pembelajaran interaktif berbasis Android pada mata pelajaran IPA untuk siswa kelas vi SD. *Jurnal Teknologi Pembelajaran Indonesia*, *11*(1), 1–15. https://doi.org/10.23887/jurnal_tp.v11i1.613

Myori, D. E., Hidayat, R., Eliza, F., Fadli, R., & Chaniago, K. (2019). Peningkatan kompetensi guru dalam penguasaan teknologi informasi dan komunikasi melalui pelatihan pengembangan media pembelajaran berbasis Android. *JTEV: Jurnal Teknik Elektro dan Vokasional*, *5*(2), 102–109. https://doi.org/10.24036/jtev.v5i2.106832

Nurdin. (2007). *Pengantar komunikasi massa*. PT. Raja Grafindo Persada.

Pratama, M. P., Al-gifari, M. K. G., Ervianti, Sofyan, & Pertiwi, A. (2022). Aplikasi notifikasi tagihan penggunaan air pelanggan PDAM Kota Makassar berbasis SMS gateway menggunakan metode FIFO (first in first out). *PATJou: Patria Artha Technological Journal*, *6*(2), 168–173. https://docplayer.info/231177677-Aplikasi-notifikasi-tagihan-penggunaan-air-pelanggan-pdam-kota-makassar-berbasis-sms-gateway-menggunakan-metode-fifo-first-in-first-out.html

Purnasari, P. D., & Sadewo, Y. D. (2021). Strategi pembelajaran pendidikan dasar di perbatasan pada era digital. *Jurnal Basicedu*, *5*(5), 3089–3100. https://doi.org/10.31004/basicedu.v5i5.1218

Putra, D. W., Nugroho, A. P., & Puspitarini, E. W. (2016). Game edukasi berbasis Android sebagai media pembelajaran untuk anak usia dini. *JIMP: Jurnal Informatika Merdeka Pasuruan*, *1*(1), 46–58. http://dx.doi.org/10.51213/jimp.v1i1.7

Riduwan. (2012). *Skala pengukuran variabel-variabel penelitian*. Alfabeta.

Rijal, A. S. (2021). Pengembangan media pembelajaran berbasis Web untuk meningkatkan kreativitas guru. *Jurnal Ideas: Pendidikan, Sosial dan Budaya*, *6*(1), 81–96. https://jurnal.ideaspublishing.co.id/index.php/ideas/article/view/238#google_vignette

Rorita, M., Ulfa, S., & Wedi, A. (2018). Pengembangan multimedia interaktif berbasis Mobile learning pokok bahasan perkembangan teori atom mata pelajaran kimia Kelas X SMA Panjura Malang. *JINOTEP (Jurnal Inovasi dan Teknologi Pembelajaran)*, *4*(2), 70–75. http://dx.doi.org/10.17977/um031v4i22018p076

Salsabila, F., & Aslam, A. (2022). Pengembangan media pembelajaran berbasis Web Google Sites pada pembelajaran IPA sekolah dasar. *Jurnal Basicedu*, *6*(4), 6088–6096. https://doi.org/10.31004/basicedu.v6i4.3155

Shoffa, S., Holisin, I., F, J., Palandi, Cacik, S., Indriyani, D., Supriyanto, E. E., Basith, A., & Giap, Y. C. (2021). *Perkembangan media pembelajaran di perguruan tinggi* (M. I. A. Fathoni (ed.)). CV. AGRAPANA MEDIA.

Sunismi. (2015). Developing guided discovery learning materials using mathematics Mobile learning application as an alternative media for the students calculus ii. *Cakrawala Pendidikan*, *34*(3), 334–346. https://doi.org/10.21831/cp.v3i3.7340

Temitayo, M., Adebis, A., & Alice, O. (2013). Computer-based test (CBT) system for university academic enterprise examination. *International Journal of Scientific & Technology Research*, *2*(8), 336–342. https://www.ijstr.org/

Zheng, Y., & Xie, Y. (2016). Metamodel for evaluating the performance of ICT in education. In *Springer Link* (Vol. 9757). Springer. https://doi.org/10.1007/978-3-319-41165-1_19